Apprenticeship and Industry Training

Plumber

Apprenticeship Course Outline

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Alberta

Apprenticeship and Industry Training

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Plumber
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Course Outline

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Apprenticeship

Apprenticeship is post-secondary education with a difference. Apprenticeship begins with finding an employer. Employers hire apprentices, pay their wages and provide on-the-job training and work experience. Approximately 80 per cent of an apprentice's time is spent on the job under the supervision of a certified journeyperson or qualified tradesperson. The other 20 per cent involves technical training provided at, or through, a post-secondary institution – usually a college or technical institute.

To become certified journeypersons, apprentices must learn theory and skills, and they must pass examinations. Requirements for certification—including the content and delivery of technical training—are developed and updated by the Alberta Apprenticeship and Industry Training Board on the recommendation of Plumber Provincial Apprenticeship Committee.

The graduate of the plumber apprenticeship program is a certified journeyperson who will be able to:

- install and maintain all plumbing systems, including hot liquid heating, water supply, water treatment, related hospital systems and compressed air and vacuum systems
- fabricate and install any of the pipe systems used for various purposes in buildings, using any type of pipe: steel, cast iron, copper, plastic, etc.
- provide safe and efficient systems which function well in conjunction with other systems
- know the rules and codes governing installations
- read and interpret plans and specifications and prepare layouts and working drawings
- be proficient with the safe use of hand tools, powered machines and equipment
- calculate material quantities
- detail components and fixtures according to specifications and assume responsibility for the end product
- relate to job situations and other trades that precede or follow
- perform assigned tasks in accordance with quality and production standards required by industry

Apprenticeship and Industry Training System

Industry-Driven

Alberta's apprenticeship and industry training system is an industry-driven system that ensures a highly skilled, internationally competitive workforce in more than 50 designated trades and occupations. This workforce supports the economic progress of Alberta and its competitive role in the global market. Industry (employers and employees) establishes training and certification standards and provides direction to the system through an industry committee network and the Alberta Apprenticeship and Industry Training Board. The Alberta government provides the legislative framework and administrative support for the apprenticeship and industry training system.

Alberta Apprenticeship and Industry Training Board

The Alberta Apprenticeship and Industry Training Board provides a leadership role in developing Alberta's highly skilled and trained workforce. The board's primary responsibility is to establish the standards and requirements for training and certification in programs under the Apprenticeship and Industry Training Act. The board also provides advice to the Minister of Advanced Education on the needs of Alberta's labour market for skilled and trained workers, and the designation of trades and occupations.

The thirteen-member board consists of a chair, eight members representing trades and four members representing other industries. There are equal numbers of employer and employee representatives.

Industry Committee Network

Alberta's apprenticeship and industry training system relies on a network of industry committees, including local and provincial apprenticeship committees in the designated trades, and occupational committees in the designated occupations. The network also includes other committees such as provisional committees that are established before the designation of a new trade or occupation comes into effect. All trade committees are composed of equal numbers of employer and employee representatives. The industry committee network is the foundation of Alberta's apprenticeship and industry training system.

Local Apprenticeship Committees (LAC)

Wherever there is activity in a trade, the board can set up a local apprenticeship committee. The board appoints equal numbers of employee and employer representatives for terms of up to three years. The committee appoints a member as presiding officer. Local apprenticeship committees:

- monitor apprenticeship programs and the progress of apprentices in their trade, at the local level
- make recommendations to their trade's provincial apprenticeship committee (PAC) about apprenticeship and certification in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- make recommendations to the board about the appointment of members to their trade's PAC
- help settle certain kinds of disagreements between apprentices and their employers
- carry out functions assigned by their trade's PAC or the board

Provincial Apprenticeship Committees (PAC)

The board establishes a provincial apprenticeship committee for each trade. It appoints an equal number of employer and employee representatives, and, on the PAC's recommendation, a presiding officer - each for a maximum of two terms of up to three years. Most PACs have nine members but can have as many as twenty-one. Provincial apprenticeship committees:

- Make recommendations to the board about:
    - standards and requirements for training and certification in their trade
    - courses and examinations in their trade
    - apprenticeship and certification
    - designation of trades and occupations
    - regulations and orders under the Apprenticeship and Industry Training Act
- monitor the activities of local apprenticeship committees in their trade
- determine whether training of various kinds is equivalent to training provided in an apprenticeship program in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- consult with other committees under the Apprenticeship and Industry Training Act about apprenticeship programs, training and certification and facilitate cooperation between different trades and occupations
- consult with organizations, associations and people who have an interest in their trade and with employers and employees in their trade
- may participate in resolving certain disagreements between employers and employees
- carry out functions assigned by the board

Plumber PAC Members at the Time of Publication

Mr. M. Badke	Edmonton	Presiding Officer
Mr. R. Giesbrecht	Edmonton	Employer
Mr. D. Pastor	Calgary	Employer
Mr. G. Young	Edmonton	Employer
Mr. S. Campbell	Grande Prairie	Employee
Mr. L. Dupalo	Red Deer	Employee
Mr. S. Eacott	Edmonton	Employee
Mr. R. Kam	Ashmont	Employee

Alberta Government

Alberta Advanced Education works with industry, employer and employee organizations and technical training providers to:

- facilitate industry's development and maintenance of training and certification standards
- provide registration and counselling services to apprentices and employers
- coordinate technical training in collaboration with training providers
- certify apprentices and others who meet industry standards

Technical Institutes and Colleges

The technical institutes and colleges are key participants in Alberta's apprenticeship and industry training system. They work with the board, industry committees and Alberta Advanced Education to enhance access and responsiveness to industry needs through the delivery of the technical training component of apprenticeship programs. They develop lesson plans from the course outlines established by industry and provide technical training to apprentices.

Apprenticeship Safety

Safe working procedures and conditions, incident/injury prevention, and the preservation of health are of primary importance in apprenticeship programs in Alberta. These responsibilities are shared and require the joint efforts of government, employers, employees, apprentices and the public. Therefore, it is imperative that all parties are aware of circumstances that may lead to injury or harm.

Safe learning experiences and healthy environments can be created by controlling the variables and behaviours that may contribute to or cause an incident or injury. By practicing a safe and healthy attitude, everyone can enjoy the benefit of an incident and injury free environment.

Alberta Apprenticeship and Industry Training Board Safety Policy

The Alberta Apprenticeship and Industry Training Board (board) fully supports safe learning and working environments and emphasizes the importance of safety awareness and education throughout apprenticeship training- in both on-the- job training and technical training. The board also recognizes that safety awareness and education begins on the first day of on-the-job training and thereby is the initial and ongoing responsibility of the employer and the apprentice as required under workplace health and safety training. However the board encourages that safe workplace behaviour is modeled not only during on-the-job training but also during all aspects of technical training, in particular, shop or lab instruction. Therefore the board recognizes that safety awareness and training in apprenticeship technical training reinforces, but does not replace, employer safety training that is required under workplace health and safety legislation.

The board has established a policy with respect to safety awareness and training:

> **The board promotes and supports safe workplaces, which embody a culture of safety for all apprentices, employers and employees. Employer required safety training is the responsibility of the employer and the apprentice, as required under legislation other than the *Apprenticeship and Industry Training Act.***

The board's complete document on its 'Apprenticeship Safety Training Policy' is available at www.tradesecrets.alberta.ca; access the website and conduct a search for 'safety training policy'.

Implementation of the policy includes three common safety learning outcomes and objectives for all trade course outlines. These common learning outcomes ensure that each course outline utilizes common language consistent with workplace health and safety terminology. Under the title of 'Standard Workplace Safety', this first section of each trade course outline enables the delivery of generic safety training; technical training providers will provide trade specific examples related to the content delivery of course outline safety training.

Workplace Health and Safety

A tradesperson is often exposed to more hazards than any other person in the work force and therefore should be familiar with and apply the Occupational Health and Safety Act, Regulations and Code when dealing with personal safety and the special safety rules that apply to all daily tasks.

Workplace Health and Safety (Alberta Employment, Immigration and Industry) conducts periodic inspections of workplaces to ensure that safety regulations for industry are being observed.

Additional information is available at www.worksafely.org

Technical Training

Apprenticeship technical training is delivered by the technical institutes and many colleges in the public post-secondary system throughout Alberta. The colleges and institutes are committed to delivering the technical training component of Alberta apprenticeship programs in a safe, efficient and effective manner. All training providers place great emphasis on safe technical practices that complement safe workplace practices and help to develop a skilled, safe workforce.

The following institutions deliver Plumber apprenticeship technical training:

Northern Alberta Institute of Technology
Red Deer College
Grande Prairie Regional College
Southern Alberta Institute of Technology
Medicine Hat College

Procedures for Recommending Revisions to the Course Outline

Advanced Education has prepared this course outline in partnership with the Plumber Provincial Apprenticeship Committee.

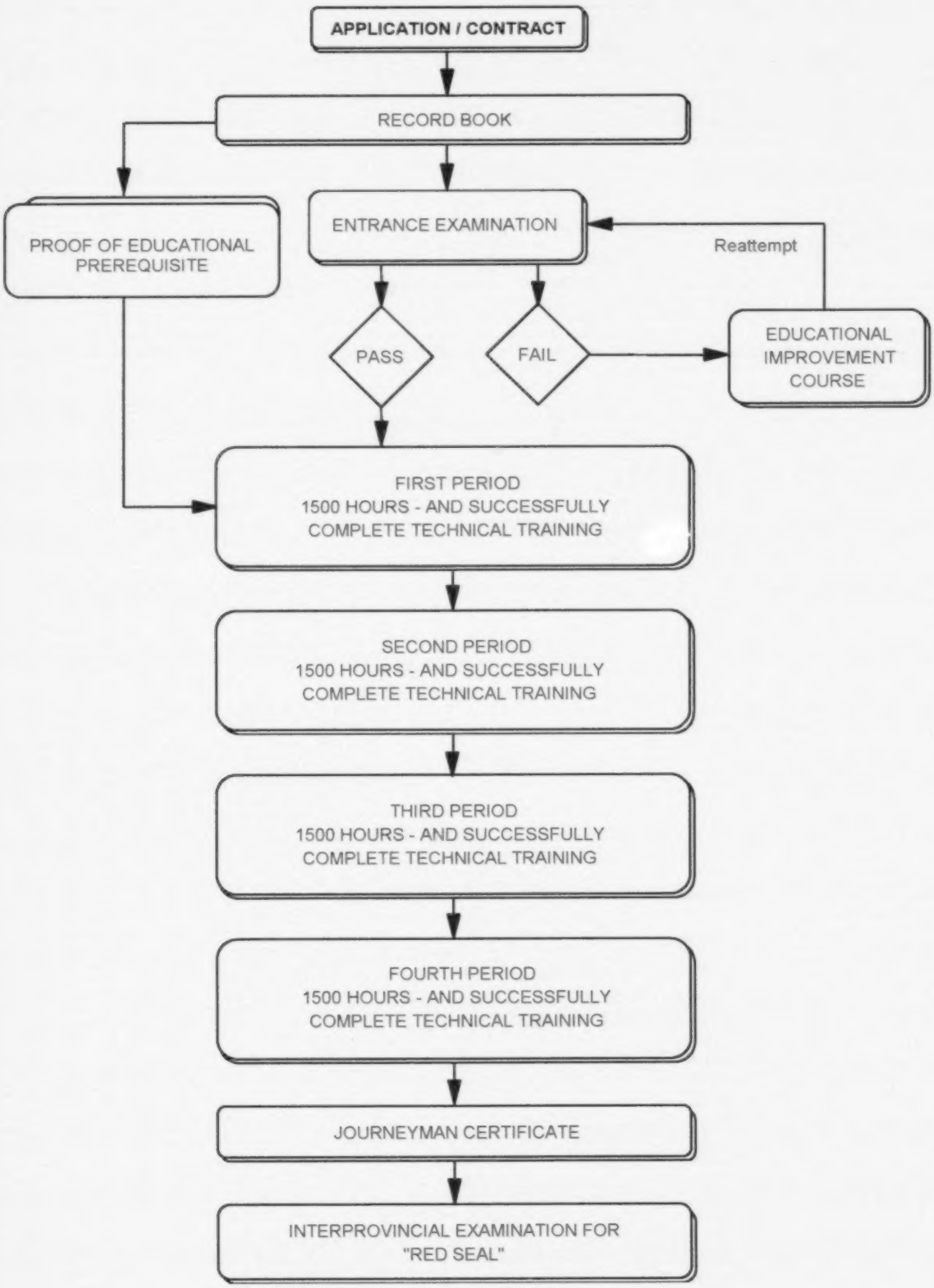
This course outline was approved on December 9, 2011 by the Alberta Apprenticeship and Industry Training Board on a recommendation from the Provincial Apprenticeship Committee. The valuable input provided by representatives of industry and the institutions that provide the technical training is acknowledged.

Any concerned individual or group in the province of Alberta may make recommendations for change by writing to:

Plumber Provincial Apprenticeship Committee
c/o Industry Programs and Standards
Apprenticeship and Industry Training
Advanced Education
10th floor, Commerce Place
10155 102 Street NW
Edmonton AB T5J 4L5

It is requested that recommendations for change refer to specific areas and state references used. Recommendations for change will be placed on the agenda for regular meetings of the Plumber Provincial Apprenticeship Committee.

Apprenticeship Route toward Certification



Plumber Training Profile
FIRST PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

SAFETY, TOOLS, EQUIPMENT AND MATERIALS
86 HOURS

A	B	C
Safety Legislation, Regulations & Industry Policy in the Trades – 3 Hours	Climbing, Lifting, Rigging and Hoisting – 2 Hours	Hazardous Material & Fire Protection – 3 Hours
D	**E**	**F**
Safe Work Practices – 4 Hours	Introduction to Rigging – 5 Hours	Hand and Power Tools – 9 Hours
G	**H**	**I**
Explosive Actuated Tools – 2 Hours	Iron Pipe and Fittings – 14 Hours	Copper Tube, Tubing and Fittings – 12 Hours
J	**K**	**L**
Welded and Flanged Piping – 7 Hours	Plastic Pipe and Fittings – 9 Hours	Cast Iron Fibreglass, Glass Lead, and Historic Piping – 6 Hours
M	**N**	
Pipe Hangers – 7 Hours	Valves – 3 Hours	

SECTION TWO

PLUMBING THEORY
46 HOURS

A	B	C
Introduction to Plumbing – Basic Single Family Dwelling – 15 Hours	Fixture Traps, Individual Vents and Roof Terminals – 6 Hours	Floor Drains, Cleanouts and Manholes – 9 Hours
D	**E**	
Plumbing Fixtures – 9 Hours	The Water Supply System – 7 Hours	

SECTION THREE

HEATING
24 HOURS

A	B	C
Introduction and Definitions – 6 Hours	Boilers and Trim – 8 Hours	Hot Water Heating Systems – 6 Hours
D		
Heat Emission Units – 4 Hours		

SECTION FOUR

GAS THEORY
34 HOURS

A	B	C
Introduction to Gasfitting Fundamentals – 6 Hours	Introduction to Gasfitting Codes and Regulations – 8 Hours	Properties of Gases and Principles of Combustion – 7 Hours
D	**E**	
Measurement and Calculation of Pressure Drop – 7 Hours	Natural Draft Burner Adjustments and Gas Consumption – 6 Hours	

SECTION FIVE

MATH, SCIENCE AND BLUEPRINT READING

50 HOURS

A

Applied Mathematics

4 Hours

B

Perimeters, Areas, Volumes, Capacities, Percentage and Grade

6 Hours

C

Temperature and Heat

6 Hours

D

Matter, Density and Relative Density

6 Hours

E

Pressure and Atmosphere

6 Hours

F

Transfer of Heat and the Effects of Heat

6 Hours

G

Introduction to Sketching and Drawing

6 Hours

H

Blueprint Interpretation

4 Hours

I

Single Line Drawing and Blueprint Interpretation

4 Hours

J

Interpretation of Blueprint Package

2 Hours

SECOND PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

PLUMBING THEORY — **60 HOURS**

A	B	C
Water Distribution Flow and Water Heaters — 8 Hours	Dual Vents, Flat Vents and Residential Storm Drains — 6 Hours	Wet Venting Residential and Commercial Groups of Fixtures — 6 Hours
D	**E**	**F**
Residential Drainage, Waste and Venting — 12 Hours	Circuit Venting of Residential Groups of Fixtures — 6 Hours	Plumbing Fixtures, Dishwashers and Garbage Grinders — 10 Hours
G	**H**	
Valve Identification and Servicing — 6 Hours	Tour — 6 Hours	

SECTION TWO

HYDRONIC HEATING — **42 HOURS**

A	B	C
Boiler Installation, Operation and Troubleshooting — 24 Hours	Installation Procedures for Terminal Heating Units and Radiant Heating Panels — 6 Hours	Expansion Control in Hydronic Heating — 6 Hours
D		
Basic Hydronic System Layout — 6 Hours		

SECTION THREE

GASFITTING — **46 HOURS**

A	B	C
Pipe Installation and Gas Line Sizing Regulation — 3 Hours	Low-Pressure Gas Line Sizing and Installation — 13 Hours	Pressure Regulators and Orifices — 8 Hours
D	**E**	**F**
Pilots, Pilot Burners, Thermocouples and Thermopiles — 8 Hours	Introduction to Flues, Draft Hoods and Vent Connections — 8 Hours	Introduction to Vents and Chimneys — 6 Hours

SECTION FOUR

PIPEFITTING AND WELDING — **36 HOURS**

A	B	C
Welding Safety, Tools and Symbols — 6 Hours	Welding and Cutting Theory — 6 Hours	Extracted Tee, Brazing, Tube Bending and Grooved Pipe — 12 Hours
D	**E**	
Bracket Project — 6 Hours	Pipefitting Project — 6 Hours	

SECTION FIVE

MATH, SCIENCE AND BLUEPRINT READING

56 HOURS

A

45° Offsets

4 Hours

B

Pressure and Flow of Gases, Buoyancy and Water Properties

8 Hours

C

Levers and Mechanical Advantage

10 Hours

D

Basic Electricity and Controls

6 Hours

E

Single Line Pipe Drawings

10 Hours

F

Specifications and Blueprint Divisions

6 Hours

G

Blueprint Views and Elevations

6 Hours

H

Interpretation of Blueprint Package

6 Hours

THIRD PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

PLUMBING THEORY
94 HOURS

A	B	C
Residential Drainage Waste and Vents Including Sub Soil Sumps and Backwater Valves 6 Hours	Commercial Floor Drains, Gang Showers, Washing Machines and Circular Rainwater Leaders 8 Hours	Island Vent, Vent Stacks and Yoke Vents Between DWV Stacks 8 Hours
D	**E**	**F**
Commercial Circuit Venting 16 Hours	Specialty Water Distribution, Control Valves and Equipment 8 Hours	Potable Water Distribution Systems 10 Hours
G	**H**	**I**
Water Heating Appliances and Hot Water Recirculation 6 Hours	Pressure Reducing Valves and Booster Pumps 4 Hours	Faucets and Flushometers 12 Hours
J	**K**	**L**
Plumbing Fixtures 8 Hours	Cross Connection Control Awareness 4 Hours	Specialty Control Valve Service Shop 4 Hours

SECTION TWO

HYDRONIC RADIANT HEATING
26 HOURS

A	B	C
Hydronic Radiant Heating and Heat Loss Calculations 6 Hours	Introduction to Hydronic Radiant Heating Design 12 Hours	Boiler Start-Up and Servicing 4 Hours
D		
Tour 4 Hours		

SECTION THREE

GASFITTING THEORY AND LAB
64 HOURS

A	B	C
Sizing Vents and Chimneys 8 Hours	Air Supply 4 Hours	Domestic Gas Fired Appliances 8 Hours
D	E	F
Electricity For Gas Appliances and Gas Controls 6 Hours	Electrical Circuits For Domestic Gas Appliances and Gas Controls 6 Hours	Gas and Electrical Controls 8 Hours
G	**H**	**I**
Propane Cylinders and Vaporization 6 Hours	Domestic Appliance Installation and Servicing Lab (Including Mid and High Efficiency) 6 Hours	Appliance Gas Controls and Wiring Lab 12 Hours

SECTION FOUR

MATH, SCIENCE AND BLUEPRINT READING

56 HOURS

A

Volumes, Capacities and Surface Areas

4 Hours

B

Square Roots, Piping Offsets and Fitting Allowances

10 Hours

C

Fixture Spacing

4 Hours

D

Grades and Elevations

8 Hours

E

Residential DWV Sketching

6 Hours

F

Commercial DWV Sketching and Drawing

8 Hours

G

Applied Blueprint Reading

16 Hours

FOURTH PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

PRIVATE WATER SUPPLY AND WATER TREATMENT
56 HOURS

A	B	C
Introduction to Private Water Supply Systems – 4 Hours	Pumps for Private Water Supply Systems – 8 Hours	Private Water Supply Pressure System Components – 4 Hours
D	**E**	**F**
Private Water Supply Pressure System Sizing – 8 Hours	Introduction to Water Treatment – 4 Hours	Impurities in Water – 6 Hours
G	**H**	**I**
Methods of Treatment and Equipment Installation – 12 Hours	Introduction to Private Sewage Disposal Systems – 6 Hours	Tour – 4 Hours

SECTION TWO

SPECIAL APPLICATIONS
32 HOURS

A	B	C
Sustainable Technologies – 6 Hours	Introduction to Residential Fire Sprinkler Systems – 4 Hours	Wet Standpipe and Dry Standpipe Fire Lines – 4 Hours
D	**E**	**F**
Swimming Pools and Spas – 4 Hours	Compressed Air Systems – 4 Hours	Medical Gas Piping – 3 Hours
G	**H**	
Lawn Irrigation – 3 Hours	Hot Tapping and Freeze Isolation – 4 Hours	

SECTION THREE

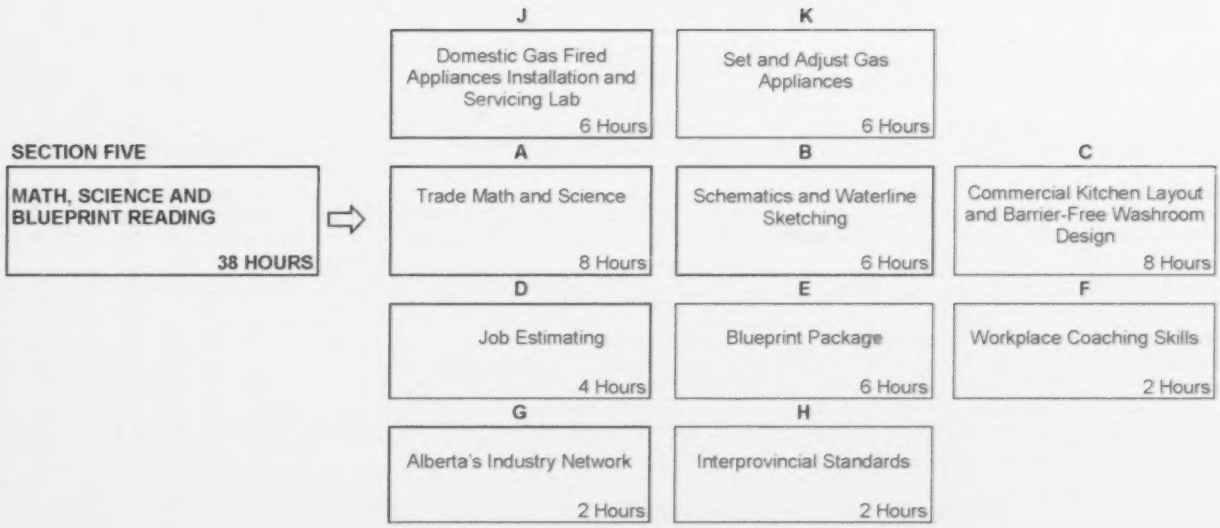
DRAIN WASTE AND VENTING
50 HOURS

A	B	C
Interceptors and Indirect Wastes – 8 Hours	Sewage Sumps, Receiving Tanks and Dumping Stations – 6 Hours	DWV, Water Distribution and Fixtures For Residential Installation – 6 Hours
D	**E**	
Specialty Plumbing Fixtures – 16 Hours	Commercial Equipment Installation – 14 Hours	

SECTION FOUR

GASFITTING THEORY AND LAB
64 HOURS

A	B	C
Low-Pressure Gas Line Layout Including Venting and Air Supply – 10 Hours	2 PSI Gas Line Layout – 4 Hours	Customer Bulk Storage Tank Installation and Vaporizers – 6 Hours
D	**E**	**F**
Additional Vents – 4 Hours	Mid-Efficiency and High- Efficiency Gas-Fired Appliances – 6 Hours	Electrical Circuits and Controls for Commercial Gas Appliances – 6 Hours
G	**H**	**I**
Combustion Analysis and Heat Exchanger Testing – 4 Hours	Wiring Electrical Circuits For Mid and High Gas Appliances – 6 Hours	Operational Tests for Mid- and High Efficiency Gas Fired Appliances – 6 Hours



NOTE: The hours stated are for guidance and should be adhered to as closely as possible. However, adjustments must be made for rate of apprentice learning, statutory holidays, registration and examinations for the training establishment and Apprenticeship and Industry Training.

FIRST PERIOD TECHNICAL TRAINING
PLUMBER TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE: ..... SAFETY, TOOLS, EQUIPMENT AND MATERIALS ..... 86 HOURS

A. Safety Legislation, Regulations & Industry Policy in the Trades .....3 Hours

Outcome: ***Describe legislation, regulations and practices intended to ensure a safe work place in this trade.***

1. Demonstrate the ability to apply the Occupational Health and Safety Act, Regulation and Code.
2. Explain the role of the employer and employee in regard to Occupational Health and Safety (OH&S) regulations, Worksite Hazardous Materials Information Systems (WHMIS), fire regulations, Workers Compensation Board regulations, and related advisory bodies and agencies.
3. Explain industry practices for hazard assessment and control procedures.
4. Describe the responsibilities of workers and employers to apply emergency procedures.
5. Describe positive tradesperson attitudes with respect to housekeeping, personal protective equipment and emergency procedures.
6. Describe the roles and responsibilities of employers and employees with respect to the selection and use of personal protective equipment (PPE).
7. Select, use and maintain appropriate PPE for worksite applications.

B. Climbing, Lifting, Rigging and Hoisting .....2 Hours

Outcome: ***Describe the use of personal protective equipment (PPE) and safe practices for climbing, lifting, rigging and hoisting in this trade.***

1. Select, use and maintain specialized PPE for climbing, lifting and load moving equipment.
2. Describe manual lifting procedures using correct body mechanics.
3. Describe rigging hardware and the safety factor associated with each item.
4. Select the correct equipment for rigging typical loads.
5. Describe hoisting and load moving procedures.

C. Hazardous Materials & Fire Protection ..... 3 Hours

Outcome: ***Describe the safety practices for hazardous materials and fire protection in this trade.***

1. Describe the roles, responsibilities features and practices related to the workplace hazardous materials information system (WHMIS) program.
2. Describe the three key elements of WHMIS.
3. Describe handling, storing and transporting procedures when dealing with hazardous material.
4. Describe safe venting procedures when working with hazardous materials.
5. Describe fire hazards, classes, procedures and equipment related to fire protection.

D. Safe Work Practices ..... 4 Hours

Outcome: ***Identify legislation and workplace programs intended to promote safe work habits and prevent injuries and fires, and describe appropriate responses to accidents.***

1. Identify common hazards in the work place.
2. Identify hazards related to confined space entry.
3. Identify personal protective equipment and first aid certification for plumbers.
4. Identify fire hazards and methods of fire prevention.
5. Describe application of the Worker's Compensation Act.
6. Demonstrate an ability to locate and interpret sections of the Occupational Health and Safety Act, General Safety Regulations as they apply to plumbing.

E. Introduction to Rigging ..... 5 Hours

Outcome: ***Perform basic rigging techniques.***

1. Describe the various types, parts, care and maintenance of natural and synthetic rope.
2. Demonstrate the proper procedure for tying popular knots and hitches.
3. Describe the various types, parts and care and maintenance of wire rope.
4. Differentiate between chain falls, come-a-longs, tirfors and snatch blocks.

F. Hand and Power Tools ..... 9 Hours

Outcome: ***Select and use hand tools common to the pipe trades.***

1. Identify hand tools used in the pipe trades.
2. Identify power tools used in the pipe trades.
3. Select the correct tool and proper size for the desired task.
4. Describe proper maintenance and repair of common hand and power tools.
5. Describe workmanship, safety and the correct operational procedures required when using common hand and power tools.
6. Identify general safety regulations pertaining to the operation of power and electrical tools.
7. Use hand and power tools common to the pipe trades.
8. Perform proper maintenance and repair procedures of common hand and power tools.
9. Perform proper workmanship, safety and correct operational procedures required when using common hand and power tools.

G. Explosive Actuated Tools ..... 2 Hours

Outcome: ***Describe the operation and safely use explosive actuated tools.***

1. Differentiate between high and low velocity explosive actuated tools.
2. Describe explosive actuated tool power loads (low and high velocity), power load strength and safety requirements.
3. Describe explosive actuated tool fasteners, accessories and applications.
4. Assess base material suitability and related fastening requirements.
5. Describe explosive actuated system safety and firing procedure.

H. Iron Pipe and Fittings ..... 14 Hours

Outcome: ***Describe, install and service ferrous pipe and fittings.***

1. Describe the composition of ferrous, alloyed and non-ferrous pipe.
2. Describe pressure ratings, schedule number, sizing and finishes pertaining to ferrous pipe.
3. Identify applications and codes, regulations and manufacturers specifications pertaining to ferrous pipe.
4. Describe the proper procedure required to cut a pipe thread using various hand and power tools.
5. Calculate cut length for threaded pipe.
6. Describe correct fabrication processes for threaded pipe.
7. Identify types, pressure ratings and symbols pertaining to threaded fittings.
8. Interpret codes and regulations pertaining to threaded pipe and fittings.
9. Thread and assemble an assigned iron pipe project to specific requirements and dimensions.
10. Hydro-test an iron pipe project to required pressure.

I. Copper Tube, Tubing and Fittings ..... 12 Hours

Outcome: ***Describe, install and service non-ferrous metal pipe and fittings.***

1. Describe types, colour code, designations and pressure ratings used for tube and tubing.
2. Describe fitting types, joining techniques and code interpretations used for tube and tubing.
3. Identify applications and codes, regulations and manufacturers specifications pertaining to solder copper tube.
4. Describe application, code, and health and safety issues pertaining to various common solders and fluxes.
5. Describe fabrication processes for soft solder joints including tools and heating process.
6. Describe electric resistance soldering.
7. Assemble and solder an assigned copper tube project to specific requirements and dimensions.
8. Hydro-test a copper tube project to required pressure.
9. Assemble an assigned flaring and compression project to specific requirements and dimensions.
10. Hydro-test a flaring and compression project to required pressure.

J. Welded and Flanged Piping ..... 7 Hours

Outcome: ***Describe the fabrication process, installation and service of welded and flanged pipe and fittings.***

1. Describe types, markings, designations and pressure ratings and code interpretations of welded pipe fittings.
2. Describe fabrication processes for welded pipe and fittings to the tack stage.
3. Describe types, markings, designations, temperature and pressure ratings and code interpretations of flanged fittings and gaskets.
4. Describe gasket preparation and proper joining techniques for a flanged joint.

5. Explain all the various components and safe work practices associated with the use of oxyacetylene welding equipment.
6. Perform the proper technique for balancing a torch.

K. Plastic Pipe and Fittings .....9 Hours

Outcome: ***Describe, install and service non-metallic pipe and fittings.***

1. Describe approved types, colour coding, applications and code considerations for plastic pipe and fittings.
2. Identify safety practices required for various fabrication techniques.
3. Describe fabrication processes for solvent welding plastic pipe.
4. Describe fabrication processes for plastic pipe using mechanical joints.
5. Describe fabrication processes for bell end joints.
6. Describe fabrication processes for plastic pipe using thermal fusion and electric fusion welding.
7. Assemble an assigned project utilizing various types of plastic pipe to specific requirements and dimensions.
8. Hydro-test a plastic pipe project.

L. Cast Iron, Fibreglass, Glass, Lead and Historic Piping .....6 Hours

Outcome: ***Describe, install and service cast iron, fibreglass, glass, lead and once popular piping materials.***

1. Identify approved grades, applications and code considerations for cast iron pipe and fittings.
2. Describe fabrication processes for cast iron piping.
3. Differentiate between cast iron pipe and cast iron water service pipe in regards to application, installation and code requirements.
4. Describe types, grades, applications, fabrication processes and code considerations for glass pipe and fittings.
5. Describe grades, applications, fabrication processes and code considerations for fibreglass pipe and fittings.
6. Describe grades, applications, fabrication processes and code considerations for lead pipe and fittings and sheet material.
7. Describe grades, applications, fabrication processes and code considerations for historic piping materials.

M. Pipe Hangers .....7 Hours

Outcome: ***Support pipe and fittings above ground.***

1. Identify pipe, tube and tubing hangers used in the plumbing industry.
2. Identify usage of various hangers and protective coatings that may be applied.
3. Describe installation techniques for various hangers.
4. Describe code requirements for hangers.
5. Describe non-power actuated fastening devices.
6. Describe the installation procedure and code requirements for various fasteners.

N. Valves .....3 Hours

Outcome: ***Select valves.***

1. Identify various styles and types of valves.
2. Describe major design variations and applications of various valves.

SECTION TWO:..... PLUMBING THEORY ..... 46 HOURS

A. Introduction to Plumbing – Basic Single Family Dwelling.....15 Hours

Outcome: ***Install a simple residential plumbing system.***

1. Discuss historical foundations, career opportunities, LAC-PAC functions and Trade regulations pertaining to pipe trades.
2. Define the terminology pertaining to the pipe trades.
3. Locate definitions in the National Plumbing Code that pertain to first period.
4. Describe terminology that applies to a plumbing system in a detached single-family dwelling.
5. Describe the operation of a simple venting system.
6. Describe required tools and installation procedures for the DWV plumbing systems in a detached single family dwelling.
7. Describe the selection and installation of fittings and pipe above and below ground.
8. Size (minimum size) and sketch a layout of basic DWV systems.
9. Interpret code requirements for DWV systems.
10. Identify testing procedures for DWV systems.
11. Perform an assigned Rough-in DWV project for a basic single family dwelling.
12. Test the Rough-in DWV project.

B. Fixture Traps, Individual Vents and Roof Terminals.....6 Hours

Outcome: ***Install and service drainage and venting systems.***

1. Describe the function of plumbing traps.
2. Describe definitions and installation procedures pertaining to fixture traps.
3. Describe definitions and installation procedures pertaining to the venting system.
4. Size (minimum) isometric drawings of individually vented traps, applying pertinent code requirements.
5. Describe common terminology and installation practices applying to roof terminals and flashing.
6. Interpret plumbing code requirements pertaining to the installation of roof terminals and flashing.

C. Floor Drains, Cleanouts and Manholes .....9 Hours

Outcome: ***Install and service drainage and venting systems in accordance with the National Plumbing Code of Canada, plumbing bulletins and manufacturer's specifications.***

1. Describe terminology and sizing as it applies to floor drains.
2. Describe installation procedures and code requirements pertaining to floor drains.
3. Describe terminology as it applies to cleanouts and manholes.
4. Describe materials, installation procedures and code requirements pertaining to cleanouts and manholes.

5. Identify the usage and limitations of various types of drain cleaning equipment and accessories for cleaning blockages.
6. Describe safe work procedures relating to liquid drain cleaners and fumes and gases present in the drainage system.
7. Describe common terminology and installation practices applying to building drains and building sewers.
8. Interpret plumbing code requirements pertaining to the installation and testing of building drains and building sewers.

D. Plumbing Fixtures.....9 Hours

Outcome: Install and service plumbing fixtures and trim.

1. Define common terminology associated with plumbing fixtures.
2. Identify common plumbing fixtures with regard to types and styles.
3. Describe common fixture trim requirements and state minimum supply connection size and fixture unit rating.
4. Describe approved materials and installation procedures pertaining to plumbing fixtures.
5. Describe the operation and service problems of all components within a water closet tank.
6. Interpret code requirements pertaining to plumbing fixtures
7. Perform an assigned plumbing fixture installation project to specific requirements and dimensions.

E. The Water Supply System .....7 Hours

Outcome: Install and service cold and hot potable water systems.

1. Describe common terminology associated with the water cycle.
2. Describe the parts of a municipal water distribution system.
3. Define terminology associated with potable water supply systems.
4. Identify names and AWWA requirements for all parts of a water service pipe.
5. Sketch and identify parts of the internal hot and cold distribution system.
6. Describe proper installation procedures for potable water supply and service piping indicating minimum sizing.
7. Interpret code and other legislated requirements pertaining to potable water supply and distribution systems.

SECTION THREE:.....HEATING.....24 HOURS

A. Introduction and Definitions .....6 Hours

Outcome: Install and service hot water heating for a single family dwelling.

1. Describe the scope of the Steamfitter - Pipefitter industry including historical foundations and career opportunities.
2. Interpret the Alberta Trade Regulations for the Steamfitter - Pipefitter trade.
3. Describe definitions pertaining to boilers.
4. Describe terminology pertaining to hot water and low pressure steam boiler trim.

5. Describe terminology pertaining to terminal heat units.
6. Describe principles of heat transfer.

B. Boilers and Trim .....8 Hours

Outcome: Identify boilers and trim for hot water and low pressure steam applications.

1. Describe boiler ratings and differences between low and high-pressure boilers.
2. Describe the materials that are used to construct boilers.
3. Describe the operation of various boilers.
4. Describe advantages and disadvantages of various boilers.
5. Identify all parts and components of boiler trim and safety controls for a hot water boiler.
6. Describe basic functions of components of boiler trim.
7. Locate and identify components and trim on a drawing or model.
8. Describe the trim on a low-pressure steam boiler and the differences between trim on the LP steam boiler and a hot water boiler.

C. Hot Water Heating Systems .....6 Hours

Outcome: Install and service hot water heating for a single family dwelling.

1. Identify various materials that are installed in hot water heating systems.
2. Describe proper layout and operation of various systems including advantages and disadvantages of each system.
3. Identify all component parts of various piping systems.
4. Describe how to eliminate air from the system.
5. Identify locations and operation of various air vents.
6. Describe the effects of convection and how water is circulated in a modern system.

D. Heat Emission Units .....4 Hours

Outcome: Install and service hot water heating for a single family dwelling

1. Identify the methods of heat emission that would be utilized in various systems.
2. Identify various heat emission units.
3. Identify various components within convectors.
4. Describe the proper installation practices in regards to fin vectors and baseboard radiation.

SECTION FOUR: ..... GAS THEORY ..... 34 HOURS

A. Introduction to Gasfitting Fundamentals .....6 Hours

Outcome: Explain and identify basic gas fundamentals and the purpose, legal status and organization of the CAN/CSA Natural Gas and Propane Installation Codes B149.1, B149.2 and the Gas Bulletins.

1. Describe and interpret historical foundations, career opportunities and Trade Regulations for the gasfitter trade.
2. Describe production, distribution and storage of natural gas.
3. Describe production, distribution and storage of propane gas.

4. State regulations pertaining to the general requirements of the gasfitter trade.
5. Identify regulations pertaining to the gasfitter trade.
6. Interpret regulations pertaining to the gasfitter trade.

B. Introduction to Gasfitting Codes and Regulations .....8 Hours

Outcome: ***Identify and apply rules pertaining to the installation of piping and tubing systems for various conditions of use in accordance with the CAN/CSA-B149.1 Natural Gas and Propane Installation Code (Section 1-4),CAN/CSA B149.2 Propane Storage and Handling Code and the Gas Safety Information Bulletins.***

1. List and describe the regulations contained in the scope section of the CAN/CSA - B149.1 *Natural Gas and Propane Installation Code*, amendments to the code and the regulations pertaining to the installer's responsibilities.
2. Use the definitions and abbreviations as found within the CAN/CSA B149.1 *Natural Gas and Propane Installation Code* and the CAN/CSA B149.2 *Propane Storage and Handling Code*.
3. State the regulations contained in the CAN/CSA B149.1 and CAN/CSA B149.2 gas codes and the *Plumbing and Gas Safety Services Bulletin* pertaining to installation of piping and fittings.
4. State the regulations contained in the CAN/CSA B149.1 and CAN/CSA B149.2 gas codes and the *Plumbing and Gas Safety Services Bulletin* pertaining to testing of piping and fittings.
5. State the regulations contained in the CAN/CSA B149.1 and CAN/CSA B149.2 gas codes and the *Plumbing and Gas Safety Services Bulletin* pertaining to purging of piping and fittings.
6. Describe correct safety practices to be used pertaining to installation of piping and fittings.
7. Describe correct safety practices to be used pertaining to the testing of piping and fittings.
8. Describe correct safety practices to be used pertaining to purging of piping and fittings.

C. Properties of Gases and Principles of Combustion .....7 Hours

Outcome: ***Explain basic gas fundamentals.***

1. State chemical formulas as required for the gasfitter trade.
2. State the relative densities, liquefaction ratios and heating values of gases.
3. Calculate various trade-related problems using properties of gases.
4. Identify definitions specific to combustion.
5. Explain the principles of combustion as a chemical change.
6. List and describe the products of complete and incomplete combustion and requirements for combustion air.
7. Describe flame adjustment techniques and correct safety practices when adjusting gas-fired equipment.

D. Measurement and Calculation of Pressure Drop .....7 Hours

Outcome: ***Define and calculate pressure drop in a gas piping system by using manometers and mechanical pressure gauges.***

1. Identify types and proper operating procedures of imperial and metric manometers and mechanical gauges used in the gasfitting trade.
2. Describe safe operating procedures and code requirements for using manometers and mechanical gauges to measure gas pressures and for gas leak testing.
3. Define and explain the terms *pressure*, *force* and *pressure drop* as they pertain to the gasfitting trade.

4. Identify factors that affect pressure drop in a piping system.
5. Calculate simple problems based on pressure drop within piping systems.

E. Natural Draft Burner Adjustments and Gas Consumption .....6 Hours

Outcome: ***Install and adjust various pressure controls and gas-fired burners using rating plates, gas meters, manometers and mechanical gauges to calculate consumption for gas-fired appliances.***

1. Determine proper appliance settings using rating plates, altitude designation and listed approval agencies.
2. List and describe requirements from the CAN/CSA B149.1 *Natural Gas and Propane Installation Code* and CAN/CSA B149.2 *Propane Storage and Handling Code* and the *Plumbing and Gas Safety Services Bulletin* pertaining to gas appliance adjustments and installer responsibilities.
3. List and define parts of a burner and common burner terminology.
4. Adjust and measure manifold pressures to determine gas consumption of burners in both imperial and metric units.
5. Identify and adjust various orifices and manifold pressures to determine gas consumption.
6. Identify and determine meter dials and meter indexes in both metric and imperial units.
7. Explain the principles of low pressure gas meter clocking.
8. Calculate gas consumption using timed meter readings.

SECTION FIVE: .....MATH, SCIENCE AND BLUEPRINT READING..... 50 HOURS

A. Applied Mathematics .....4 Hours

Outcome: ***Implement basic mathematical skills relevant to the trade, utilizing metric and imperial measurements.***

1. Describe the operation of a basic calculator.
2. Perform basic arithmetic calculations using whole numbers, fractions and decimals with the aid of a calculator.
3. Perform number conversions using whole numbers, fractions and decimals.
4. Perform measurement conversions using whole numbers, fractions and decimals.

B. Perimeters, Areas, Volumes, Capacities, Percentage and Grade .....6 Hours

Outcome: ***Solve mathematical problems involving volumes, capacities, perimeters, areas, percentage and grade.***

1. Apply formulas for calculating perimeters of a rectangle, triangle and a circle.
2. Apply formulas for calculating areas of regular-shaped objects.
3. Apply the formula for calculating percentages.
4. Calculate grades in both percentage and fraction per foot.
5. Apply formulas for calculating volumes and capacities of regular shaped solids, tanks and cylinders.
6. Calculate capacity of regular shaped tanks and cylinders using both metric and imperial values.

C. Temperature and Heat .....6 Hours

Outcome: ***Implement basic heat calculations relevant to the trade, utilizing both metric and imperial values.***

1. Perform temperature conversion calculations.
2. State the specific heat values of water and air.
3. Define latent heat and state the latent heat values for water, ice, steam and propane.
4. Calculate sensible and latent heat values.

D. Matter, Density and Relative Density .....6 Hours

Outcome: ***Define terminology related to matter and define and calculate densities and relative densities.***

1. Explain the terms matter, element, compound and mixture and identify the three states of matter.
2. Explain adhesion, cohesion, surface tension and capillarity.
3. Explain density and calculate density, mass and volume of substances.
4. Explain relative density and calculate mass, volume and density of substances.

E. Pressure and Atmosphere .....6 Hours

Outcome: ***Utilize standard science fundamentals that are relevant to the plumbing trade, applying both metric and imperial values.***

1. Explain the terms pressure and force.
2. State the six principles of hydrostatic pressure.
3. State pressure constants used for calculating pressures.
4. Perform pressure and force calculations in both imperial and metric units.
5. Describe atmospheric pressure and the effect of altitude.
6. Perform calculations to convert pressures from gauge to absolute.

F. Transfer of Heat and the Effects of Heat .....6 Hours

Outcome: ***Describe the heat transfer process and apply to relative pipe trades.***

1. Explain the three methods of heat transfer.
2. Explain the principles of expansion and contraction.
3. Perform calculations for linear expansion using coefficient of expansion tables.
4. Identify useful and detrimental effects of expansion and contraction.

G. Introduction to Sketching and Drawing .....6 Hours

Outcome: ***Draw and interpret basic orthographic drawings.***

1. Explain the use of drafting equipment.
2. Locate and identify typical lines found on a blueprint typical of a three bedroom single family dwelling.
3. Identify the three basic views of an orthographic projection.
4. Draw and label the three basic views of an orthographic drawing.

H. Blueprint Interpretation .....6 Hours

Outcome: ***Interpret blueprints and use a scale to determine correct dimensions in metric and imperial values.***

1. Explain usage of typical scales.
2. Interpret architectural dimensions with the aid of a scale rule.
3. Explain typical symbols found on construction blueprints.
4. Describe common piping symbols.
5. Identify sections of a simple object.
6. Draw sections of a simple object.

I. Single Line Drawing and Blueprint Interpretation .....4 Hours

Outcome: ***Draw and label single line isometric pipe drawings and interpret symbols and specifications from a blueprint of a three bedroom single family dwelling.***

1. Draw and label orthographic single-line piping drawings and conversion to isometric drawings containing 90° elbows and tees.
2. Draw and label isometric single-line piping drawings containing 90° elbows and tees.
3. Interpret symbols and specifications on blueprints.
4. Interpret blueprints of a typical three bedroom single-family dwelling including views and elevations of a building.

J. Interpretation of Blueprint Package .....2 Hours

Outcome: ***Interpret blueprints.***

1. Identify drawings in the drawing package.
2. Interpret symbols used in a typical detached three bedroom single family dwelling.
3. Interpret specifications on blueprints.
4. Interpret a typical single dwelling residential site plan.
5. Interpret blue used in a typical detached three bedroom single family dwelling.

SECOND PERIOD TECHNICAL TRAINING
PLUMBER TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE: ..... PLUMBING THEORY ..... 60 HOURS

A. Water Distribution Flow and Water Heaters ..... 8 Hours

Outcome: ***Install and service water distribution systems and hot water tanks, including testing of the system in a residential building according to the National Plumbing Code of Canada.***

1. Interpret the National Plumbing Code requirements pertaining to the water distribution system in a building including testing.
2. State the minimum and maximum pressures within a water distribution system.
3. Describe material requirements, water meter requirements and installation procedures for hot and cold water distribution systems.
4. Sketch and size hot and cold water distribution piping for a house using appropriate tables.
5. Describe the various means by which domestic water tanks may be heated.
6. Describe the operation of storage and instantaneous water heaters.
7. Describe safety components required with gas fired and electrically heated hot water tanks.
8. State capacities and code requirements for hot water tanks.

B. Dual Vents, Flat Vents and Residential Storm Drainage ..... 6 Hours

Outcome: ***Install and service residential drainage and venting systems and residential storm drainage systems.***

1. Describe a dual vent and identify correct installation of dual vents.
2. Interpret plumbing code requirements and correctly size dual vents.
3. Describe a flat vent and identify usage, installation and alternatives to a flat vent.
4. Interpret plumbing code requirements and correctly size flat vents.
5. Describe terminology that applies to residential storm drainage systems including weeping tile connections and sumps.
6. Interpret plumbing code requirements and state minimum size for residential storm drainage systems.

C. Wet Venting Residential and Commercial Groups of Fixtures ..... 6 Hours

Outcome: ***Install groups of fixtures using appropriate drainage and wet venting methods.***

1. Define the term wet venting and terminology associated with various groups of wet vented fixtures.
2. Identify the wet vent and circuit vent portion of a vet vented group.
3. Identify installation techniques for horizontal and vertical wet vents and circuit vents.
4. Identify tables for sizing wet vents and circuit vents.

5. Lay out and size various wet vented groups of fixtures.
6. Interpret plumbing code requirements for the correct installation and sizing of wet vents.

D. Residential Drainage, Waste and Venting ..... 12 Hours

Outcome: ***Apply rules pertaining to the installation of drainage and venting systems for various conditions of use.***

1. Identify installation procedures for DWV systems.
2. Identify methods of controlling expansion in DWV systems.
3. Identify various sizing tables and size a system.
4. Layout and sketch various DWV systems for residences that include one wet vented group of fixtures.
5. Develop a material list for a residential DWV system.
6. Interpret plumbing code requirements for correct installation and testing of DWV systems.
7. Perform an assigned Residential Rough-in with Double Plumbing project to specific requirements and dimensions.
8. Test the assigned Residential Rough-in project.

E. Circuit Venting Residential Groups of Fixtures ..... 6 Hours

Outcome: ***Install groups of less than nine fixtures, using appropriate drainage and venting methods.***

1. Define circuit venting and terminology associated with circuit venting small groups of fixtures
2. Compare wet vented and circuit vented groups of fixtures.
3. Describe installation techniques for simple circuit vented groups of fixtures.
4. Identify tables for sizing circuit vented groups of fixtures.
5. Layout, sketch and size various simple circuit vented groups of fixtures.
6. Interpret plumbing code requirements for the correct installation and testing of a circuit vented system.

F. Plumbing Fixtures, Dishwashers and Garbage Grinders ..... 10 Hours

Outcome: ***Install and service residential plumbing fixtures, trim and appliances, including the garbage grinders and dishwashers.***

1. Define terminology associated with various residential and commercial plumbing fixtures, garbage grinders, dishwashers, domestic clothes washers, service sinks, mop sinks, shower stalls and shower strainers with membranes.
2. List the fixture unit rating for the fixtures listed in objective one including water and waste connection size requirements.
3. Describe construction materials for plumbing fixtures for residential and commercial applications.
4. Describe different types of garbage grinders.
5. Describe installation of fixtures including the use of a rough-in book.
6. Describe fixture trim required for each of the fixtures listed in objective one.
7. Describe correct installation of dishwashers including water supply.
8. Describe proper drainage and venting requirements for garbage grinders and dishwashers.

9. Describe proper safety precautions when working with residential and commercial fixtures. (Examples: sharp edges, weight, electrical precautions, awkward locations).

10. Interpret plumbing code requirements for fixtures and appliances.

G. Valve Identification and Servicing ..... 6 Hours

Outcome: Identify and service common valves used in the pipe trades.

1. Identify major classification and application of valves used in the pipe trades.
2. Identify characteristics and factors that influence valve selection.
3. Describe common maintenance problems and service procedures for valves.
4. Interpret codes, regulations and manufacturer's instruction pertaining to valves and installation.
5. De-assemble, identify components parts and re-assemble valves.
6. Check that valve is operating correctly.

H. Tour ..... 6 Hours

Outcome: Tour commercial facility suitable for second period apprentices.

1. Identify major plumbing equipment.
2. Identify the installed fixtures, accessories, equipment and controls. List and describe their function.
3. Describe the requirements for safe installation of fixtures, accessories, equipment and controls.

SECTION TWO: ..... HYDRONIC HEATING ..... 42 HOURS

A. Boiler Installation, Operation and Troubleshooting ..... 24 Hours

Outcome: Install and service hot water heating boilers.

1. Describe the types and uses of boilers found in small commercial and apartment applications.
2. State installation and testing procedures for boilers.
3. Solve common service problems associated with boilers.
4. Solve common service problems associated with systems.
5. List the trim components required for the operation of a hydronic heating system.
6. Identify the function of trim components required for the operation of a hydronic heating system.
7. Describe the function of each trim component as it is related to the overall operation of a hydronic heating system.
8. State, when, how and where a low water cut-off is installed and how it operates.
9. Troubleshoot boilers, their trim and the components of a hydronic heating system.

B. Installation Procedures for Terminal Heating Units and Radiant Heating Panels ..... 6 Hours

Outcome: Install and service residential and commercial hot water heat transfer units, including radiant ceiling panels.

1. Identify the parts of a residential baseboard hot water heating system including zones, wild loop and a unit heater for a garage.
2. Describe installation techniques for various terminal heating units.

3. Define radiation and describe the common types and styles of radiant ceiling panels.
4. Describe installation techniques for radiant ceiling panels and associated trim components.

C. Expansion Control in Hydronic Heating ..... 6 Hours

Outcome: ***Install and service a residential hot water two-pipe heating system.***

1. Describe methods of controlling expansion and state the reason why control is necessary.
2. Describe placement of anchors, guides and expansion control devices.
3. Calculate the expansion of a typical pipe installation.
4. Identify problems due to improper expansion control.

D. Basic Hydronic System Layout ..... 6 Hours

Outcome: ***Install and service a residential hot water two-pipe heating system.***

1. Define terminology pertaining to the calculation of heat loss values.
2. Calculate a simple heat loss through a typical wall.
3. Given heat loss for a total building, describe procedure and calculate the heat loss for one room of a single-family dwelling.
4. Describe the method used to size the boiler and identify correct start-up procedures.
5. Describe the method used to size piping, expansion tank and pump.
6. Identify code requirements for hydronic heating systems.

SECTION THREE: ..... GASFITTING ..... 46 HOURS

A. Pipe Installation and Gas Line Sizing Regulations ..... 3 Hours

Outcome: ***Apply rules pertaining to the installation of piping and tubing systems for various conditions of use.***

1. Explain the regulations pertaining to the installation of gas line piping from the CAN/CSA - B149.1 *Natural Gas and Propane Installation Code and STANDATA* that relate to minimum and maximum pipe sizes from sizing tables.
2. Explain regulations pertaining to sizing various types of piping material from the CAN/CSA - B149.1 *Natural Gas and Propane Installation Code* that relate to minimum and maximum pipe sizes and regulations over-ruling sizes determined from sizing tables.
3. Calculate hanger spacing and requirements for different types and sizes of gas lines.

B. Low-Pressure Gas Line Sizing and Installation ..... 13 Hours

Outcome: ***Install and service pipe, tubing and fittings on low pressure gas lines.***

1. Determine the type of gas being used.
2. Examine layout of gas line in building and determine longest run of gas piping.
3. Determine the volume of gas being consumed by individual appliances and gas delivery requirements for each section of the gas line.
4. Correctly size gas lines using a gas line-sizing table.
5. Correctly size gas lines for various installations.
6. Describe safe procedure for leak testing and purging of gas lines.
7. Describe types of gas pressure measurement and pressure drop.

8. Following code and general safety requirements, perform an assigned Gas Line Installation project.

9. Test an assigned Gas Line installation project to correct code requirements.

C. Pressure Regulators and Orifices ..... 8 Hours

Outcome: ***Install and service various types of gas pressure controls and burner orifices and adjust gas line pressures.***

1. Describe types, operating principles and applications of various gas pressure regulators.
2. Identify various regulator sizing tables and list and describe correct installation procedures for various regulators.
3. List and describe maintenance procedures for various regulators.
4. List some common pressure regulator problems and describe and apply corrective procedures.
5. Identify various types of orifices.
6. Use orifice-sizing charts to determine orifice sizing for specific gas consumption and pressure in both metric and imperial units.
7. Select the correct type of orifice and demonstrate drilling of an orifice to correct size using appropriate methods.
8. Demonstrate proper procedure for testing of orifice, adjust manifold pressure if necessary and clock meter to determine accuracy.

D. Pilots, Pilot Burners, Thermocouples and Thermopiles ..... 8 Hours

Outcome: ***Identify and service pilots, pilot burners, thermocouples and thermopiles.***

1. List and describe common pilot burner types and terminology.
2. List and describe the characteristics of pilot burners and identify parts of aerated and non-aerated pilot burners.
3. State the primary purpose of a gas pilot and describe burner ignition tests performed on all pilots.
4. List and describe operating principles of thermocouples and thermopiles.
5. List and describe the operation tests performed on proven pilots energizing a thermocouple.
6. List and describe methods of installing thermocouples and thermopiles on standard circuits.
7. List and describe operational test performed on thermocouples and thermopiles.
8. List and describe diagnostic tests for thermocouples and state major causes for thermocouple failures.

E. Introduction to Flues, Draft Hoods and Vent Connections ..... 8 Hours

Outcome: ***Install and service draft hoods and vent connectors.***

1. Define terminology pertaining to flues and draft control devices.
2. Identify and describe flue collars and common types of draft hoods including correct installation procedures.
3. Explain regulations pertaining to the sizing, installation and use of draft hoods on gas burning appliances as listed in the CAN/CSA - B149.1 *Natural Gas and Propane Installation Code* and *STANDATA*.
4. Describe correct installation procedures for single and double acting barometric dampers.
5. Explain regulations pertaining to the selection, sizing and installation of draft control devices as specified in the CAN/CSA B149.1 *Natural Gas and Propane Installation Code* and *STANDATA*.

6. List, define and describe vent connectors and proper installation techniques.
7. Explain regulations pertaining to vent connectors as listed in the CAN/CSA B149.1 *Natural Gas and Propane Installation Code* and *STANDATA*.
8. Size vent connectors using minimum size rule.

F. Introduction to Vents and Chimneys ..... 6 Hours

Outcome: Install and service vents and chimneys.

1. List and describe venting principles and application of various vents for gas applications.
2. List and describe correct sizing and installation procedures for vents used on gas appliances.
3. Explain regulations pertaining to vents, as listed in the CAN/CSA B149.1 *Natural Gas and Propane Installation Code* and *STANDATA*.
4. List and describe various chimneys and application for gas and dual fuel appliances.
5. List and describe correct sizing and installation procedures for chimneys used for gas and dual fuel appliances.
6. Explain regulations pertaining to chimneys, as listed in the CAN/CSA B149.1 *Natural Gas and Propane Installation Code* and *STANDATA*.

SECTION FOUR: .....PIPEFITTING AND WELDING ..... 36 HOURS

A. Welding Safety, Tools and Symbols ..... 6 Hours

Outcome: Identify fabrication processes for welded pipe and fittings.

1. Identify safety practices pertaining to welding.
2. Describe the hand tool required for welding.
3. Describe the use and maintenance of grinders and discs.
4. Identify various welding symbols used in the pipe trades.

B. Welding and Cutting Theory ..... 6 Hours

Outcome: Identify fabrication processes for welded pipe and fittings.

1. Identify different types of metals using simple tests.
2. Describe the use of a cutting torch.
3. Describe the importance of proper tip selection and maintenance.
4. Describe the types and usage of various filler rods and fluxes.

C. Extracted Tee, Brazing, Tube Bending and Grooved Pipe ..... 12 Hours

Outcome: Install and service copper and iron pipe and fittings.

1. Identify approved applications and equipment required for mechanical T-pulled joints.
2. Describe the process for preparing a T-pulled mechanical joint.
3. Identify the approved application name, grade, size and materials, including flux, used for brazed and silver soldered joints in piping systems.
4. Identify the equipment pertaining to brazing and silver soldering, select the required tip and balance a torch.
5. Identify by name, grade, size and material, the tools, tube and tubing used for bending purposes in the pipe trades.

6. Recognize grooved pipe and fittings and interpret markings found on various grooved fittings and identify blueprint symbols used for grooved joints.
7. Describe the pressure and temperature ratings including colour coding of gaskets and correct installation procedure for groove pipe and fittings.
8. T-pull to following prescribed procedures.
9. Braze project to correct dimensions following prescribed procedures.
10. Bend tubing to correct dimensions following prescribed procedures.
11. Perform an assigned grooved pipe project to correct dimensions following prescribed procedures.

D. Bracket Project ..... 6 Hours

Outcome: Fabricate a welded pipe bracket to specific dimensions.

1. Select, mark and measure materials to required dimensions.
2. Demonstrate proper tip selection and maintenance.
3. Use cutting torch safely, following correct procedures.
4. Assemble bracket, choose correct filler rod and tack or weld pipe bracket to specific requirements.

E. Pipefitting Project ..... 6 Hours

Outcome: Fabricate a steel piping spool piece to specific dimensions.

1. Select by name, grade, symbols, size and the materials detailed on spool sheet.
2. Mark and measure materials to required dimensions.
3. Cut and prepare pipe-ends and fittings to required specifications.
4. Use hand and power tools safely, following correct procedures.
5. Assemble spool, and tack pipe to specific requirements.

SECTION FIVE ..... MATH, SCIENCE AND BLUEPRINT READING ..... 56 HOURS

A. 45° Offsets ..... 4 Hours

Outcome: Implement mathematical calculations relevant to the trade.

1. Define terminology applied to 45° offsets.
2. Calculate simple 45° offsets including fitting allowance.
3. Calculate 45° offsets around a corner.
4. Describe and apply the Pythagorean Theorem.

B. Pressure and Flow of Gases, Buoyancy and Water Properties ..... 8 Hours

Outcome: Use standard science fundamentals relevant to the trade.

1. Describe the chemical properties of water and the effect of temperature in a hot water heating system.
2. State the three laws of buoyancy and describe the effect of buoyancy on regular shaped objects submersed in water.
3. Describe the terminology pertaining to the flow of water in a plumbing system.
4. Describe the operation of a venturi and the cause, effects and prevention of cavitation.

5. State formulas for solving simple head pressure calculations.
6. Describe the principles of Boyle's Law on the behaviour of perfect gases.
7. Describe the principles of Charles' Law on the behaviour of perfect gases.
8. Calculate simple problems using Boyle's and Charles' Law.

C. Levers and Mechanical Advantage ..... 10 Hours

Outcome: ***Apply standard science to Levers and Mechanical Advantage.***

1. Describe pulleys, classifications of levers and mechanical advantage.
2. Apply the fundamentals of pulleys, levers and mechanical advantage.
3. Describe characteristics, including safe work loads and detrimental application of different slings used for hoisting pipe, appliances, and components.
4. Describe applications and positioning of cranes, hoists and cherry pickers.
5. Identify hand signals and use when directing a crane.
6. Describe safety requirements for various types of scaffolds and platforms used in the construction industry.

D. Basic Electricity and Controls ..... 6 Hours

Outcome: ***Apply standard science fundamentals to principles of electricity.***

1. Describe basic principles of electricity including direct and alternating current flow, electrolysis and electromagnetism.
2. Sketch and describe simple electrical circuits, and the calculation of Ohm's Law.
3. Describe the basic function of transformers.
4. Describe the basic functions and use of a multi-meter.

E. Single Line Pipe Drawings ..... 10 Hours

Outcome: ***Interpret isometric and orthographic drawings.***

1. Describe the process for drawing orthographic and isometric views of 90° offsets.
2. Describe the process for drawing orthographic and isometric views of 45° offsets.
3. Describe the process for drawing isometric single line piping arrangements following proper orientation from orthographic north to isometric north.
4. Describe the process for drawing DWV piping using orthographic techniques.
5. Describe the process for drawing DWV piping using isometric techniques.

F. Specifications and Blueprint Divisions ..... 6 Hours

Outcome: ***Utilizing specifications and blueprints, locate the information required to complete the mechanical portion of a construction project.***

1. Define the five common divisions of a residential blueprint.
2. Describe the purpose of blueprint divisions.
3. Explain the Constructions Specification Institute (CSI) format.
4. Interpret simple architectural and mechanical specifications.

G. Blueprint Views and Elevations ..... 6 Hours

Outcome: ***Locate information that is important for the mechanical portion of a construction project and to locate elevations on a set of blueprints or calculate them from available information.***

1. Identify views and drawings of a building.
2. Interpret views and drawings of a building.
3. Identify various elevations in both imperial and metric measurements.
4. Interpret various elevations found on a blueprint.

H. Interpretation of Blueprint Package ..... 6 Hours

Outcome: ***Read and interpret blueprints contained in the package.***

1. Identify schedules and specifications.
2. Interpret views of a building.
3. Identify various elevations.
4. Identify plumbing fixtures and locations of fixtures.
5. Determine location of DWV and water distribution systems.
6. Analyze blueprints for possible installation conflicts.

THIRD PERIOD TECHNICAL TRAINING
PLUMBER TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE: ..... PLUMBING THEORY ..... 94 HOURS

A. Residential Drainage Waste and Vents Including Sub Soil Sumps and Backwater Valves... 10 Hours

Outcome: ***Install the most common plumbing fixtures, along with sumps, backwater valves, drains and vents.***

1. Identify the fixtures that may be found in a large single family dwelling.
2. Explain where protection from backflow in a drainage, waste and vent (DWV) system is necessary.
3. State the purpose and under what conditions a sump pump must be installed.
4. Describe the installation procedures for DWV systems above and below ground.
5. Size a drainage and venting system including backwater valve (BWV) and sump pump and develop material list.
6. Describe regulations pertaining to the design and installation of drainage and venting systems, sump pumps and backflow devices in a two storey house.
7. Perform an assigned Residential Rough-in project with connections for jet tub, double plumbing, bar sink, back water and weeping tile protection.
8. Test the Residential Rough-in project.

B. Commercial Floor Drains, Gang Showers, Washing Machines and Circular Rainwater Leaders ..... 8 Hours

Outcome: ***Install floor drains gang showers, washing machines and circular rainwater leaders.***

1. Define floor drains and describe installation practices and code requirements for various applications.
2. Illustrate multiple floor drain installations and describe code requirements for sizing.
3. Describe installation procedures for gang showers including code requirements.
4. Define washing machines and describe installation practices and code requirements for various applications.
5. Define rainwater leader and terms pertaining to area storm water and describe installation methods for rainwater leaders, area storm drains and correctly size piping following code requirements.

C. Island Vents, Vent Stacks and Yoke Vents Between DWV Stacks ..... 8 Hours

Outcome: ***Install island vents, vent stacks and yoke vents and apply the rules pertaining to the installation of venting systems for various conditions of use.***

1. Describe island vents and installation technique.
2. Describe sizing requirements for island vents including cleanout locations.
3. Describe a vent stack and the principle of operation.

4. Identify code requirements and sizing procedure for vent stacks.
5. Define and size vents required between DWV stacks in a high rise building including offsets as required by code.

D. Commercial Circuit Venting ..... 12 Hours

Outcome: ***Install groups of more than nine fixtures, using the appropriate venting methods, when more than six fixture units pass by the lowest point of connection.***

1. Define commercial circuit venting.
2. Illustrate various combinations of circuit vented plumbing groups.
3. Identify additional vents required for commercial groups of fixtures.
4. Describe installation techniques for circuit vented applications.
5. Identify code requirements for circuit, additional circuit and relief vents.
6. Size various piping configurations using appropriate tables.
7. Perform an assigned Commercial Rough-in project with circuit vented fixtures with continuous and relief vents.
8. Test the Commercial Rough-in project.

E. Specialty Water Distribution, Control Valves and Equipment ..... 8 Hours

Outcome: ***Understand the application and method of operation of urinal flush tanks, trap primers, different styles of temperature controlled valves and the proper method of connection for a sterilizer.***

1. Identify the various automatic urinal flush tanks and components.
2. Describe installation of an automatic urinal flush tank including regulation of flush, waterline sizing requirements and troubleshooting.
3. Describe various types of trap seal primers and their operations.
4. Describe sizing installation and troubleshooting of various trap seal primers.
5. Identify the various mixing valves, control valves and specialty equipment used in the plumbing trade.
6. State the application for the various mixing valves, control valves and specialty equipment used in the plumbing trade.
7. Describe the installation procedure for the various mixing valves, control valves and specialty equipment used in the plumbing trade.
8. Describe troubleshooting techniques for valves for the various mixing valves, control valves and specialty equipment used in the plumbing trade.

F Potable Water Distribution System ..... 10 Hours

Outcome: ***Install and service water distribution systems in accordance with the National Plumbing Code, plumbing bulletins and/or manufacturer specifications.***

1. Describe the two basic water distribution systems.
2. Describe the operation and application of a municipal water distribution system.
3. List and describe the conditions in which a booster pump is required.
4. Describe the importance and placements of air vents, vacuum breakers, air chambers and shock absorbers.

5. State how fixture unit rating applies to the sizing of potable water lines and list the fixture unit rating for common plumbing fixtures.
6. Size a commercial potable water distribution system for a multi-storey high rise including: flush valves, recirculating line and booster pump.
7. Describe proper water meter installation requirements for water meters larger and smaller than one inch.
8. Describe proper locations for shutoff valves and installation procedures for commercial lawn service faucets.
9. Describe the methods of controlling condensation on potable water distribution lines.
10. Interpret code and requirements for installation and sizing of potable water lines including flushing and testing.

G. Water Heating Appliances and Hot Water Recirculation ..... 6 Hours

Outcome: Install and service hot water heaters and hot water recirculation piping systems.

1. Identify types of water heaters available for residential and commercial applications.
2. Describe sizing, operation and application of water heaters available for residential and commercial applications.
3. Describe installation techniques for residential and commercial water heaters including parallel and series connections.
4. Interpret code regulations pertaining to the installation of hot water heaters.
5. List applications and common terminology associated hot water recirculation installations.
6. Describe installation techniques associated with hot water recirculation installations.

H. Pressure Reducing Valves and Booster Pumps ..... 4 Hours

Outcome: Install and service pressure reducing valves and booster pumps.

1. Describe types and operation of pressure reducing valves and booster pumps.
2. Describe installation requirements and code references for pressure reducing valves.
3. Describe types and operation of booster pumps.
4. Describe installation requirements, trouble shooting procedures and code references for booster pump installations.

I. Faucet and Flushometers ..... 12 Hours

Outcome: Install and service faucets and flush valves.

1. Identify types of faucets.
2. Describe manufacturer's installation requirements for various faucets.
3. Identify common faucet components for various faucets.
4. State service problems associated with various facets and describe procedures for correction of service problems.
5. List tools and materials required for installation and servicing of various faucets.
6. Describe code regulations and safety requirements for installing and repairing faucets.
7. Describe the types of flush valves approved for the installation on urinals and water closets.
8. Describe parts operation and adjustment of various flush valves.

9. Perform an assigned Flush Valve troubleshooting and service related project.
10. Perform an assigned Faucet troubleshooting and service related project.

J. Plumbing Fixtures ..... 8 Hours

Outcome: Install and service plumbing trim, fixtures and appliances.

1. Describe common terminology associated with the following fixtures: jet tubs, bar sinks, bidets, drinking fountains, gang showers, urinals, laboratory sinks and three compartment sinks.
2. Describe the operation of each fixture.
3. Describe the materials from which the fixtures listed above may be manufactured.
4. Describe common fixture trim required for the listed fixtures.
5. List the water and drain sizing requirements for each of the listed fixtures.
6. Describe proper installation technique for each of the fixtures.
7. Identify common service problems for each fixture.
8. Identify code and requirements for each fixture.

K. Cross Connection Control Awareness ..... 4 Hours

Outcome: Install and service cross-connection control devices.

1. Define the term cross connection control and state the requirements for tester certification.
2. Briefly discuss the history of cross connection control in Canada and the program status in Alberta.
3. Describe definitions that pertain to cross connection control.
4. Describe the classification of hazards and list typical health issues that may result from cross connection.
5. State the liabilities and responsibilities at all levels of a cross connection control program.
6. List case histories of cross connections in Canada resulting in inadequate protection.
7. State regulations pertaining to cross-connection control.
8. Identify the major categories of cross connection control devices and describe their operation.
9. Describe installation procedures for each category of cross-connection devices and list examples of preventing backflow in a potable water supply.
10. Describe the testing procedure for a pressure vacuum breaker.

L. Specialty Control Valve Service Shop ..... 4 Hours

Outcome: Identify, troubleshoot and correctly service specialty control valves.

1. Identify the various types of specially control valves.
2. Identify various on/off mechanisms associated with specialty control valves.
3. Identify common service problems associated with control valves.
4. Select tools and disassemble valves and select replacement parts using manufacturer's catalogues and service manuals.
5. Replace necessary parts and re-assemble leaving flush valves in a safe operating condition.

SECTION TWO: ..... HYDRONIC RADIANT HEATING..... 26 HOURS

A. Hydronic Radiant Heating and Heat Loss Calculations .....6 Hours

Outcome: Install and service residential radiant floor hot water heating systems.

1. List definitions pertaining to hydronic radiant heating systems.
2. Describe the differences between hydronic radiant heating and other heating systems.
3. Describe the advantages and disadvantages of a hydronic radiant heating system, including problems with poorly designed systems.
4. Describe applications for hydronic radiant heating systems and materials used for installations.
5. Describe the importance of proper system water temperatures.
6. Describe the process for determining heat loss for one room of a single-family dwelling.
7. Calculate the heat loss for one room of a single-family dwelling.

B. Introduction to Hydronic Radiant Heating Design .....12 Hours

Outcome: Install and service residential radiant floor hot water heating systems.

1. Describe process for determining the number of zones and size, spacing and length of piping required.
2. Compare various piping layouts and state their application.
3. Describe installation practice of circuits and supplemental heat source when required.
4. Describe methods of zoning and balancing systems including header sizing.
5. Describe the procedure for pump selection.
6. Describe types of boilers, controls and water requirements for radiant floor heating system.
7. List code requirements for radiant floor hydronic heating systems.

C. Boiler Start-Up and Servicing .....4 Hours

Outcome: Install and service residential radiant floor hot water heating systems.

1. Describe manufacturers' start-up procedure.
2. Describe service procedures for boilers.
3. Describe service procedures for controls.
4. Describe basic maintenance procedures for radiant floor heating system.

D. Tour .....4 Hours

Outcome: Tour mechanical facility suitable for third period apprentices.

1. Identify major heat generating equipment.
2. Identify the installed accessories and controls and list and describe their function.
3. Describe the requirements for safe installation generating equipment, accessories and controls.

SECTION THREE: .....GASFITTING THEORY AND LAB ..... 64 HOURS

A. Sizing Vents and Chimneys .....8 Hours

Outcome: ***Apply rules pertaining to the installation of venting systems for gas-fired appliances under various conditions of use.***

1. List and describe regulations that relate to minimum and maximum vent sizing requirements that overrule vent sizes determined from the vent sizing table.
2. Calculate natural draft vent sizes for a single appliance using both tables and rule of thumb method.
3. Calculate vent connector sizes for multiple appliances (natural draft) using both sizing tables and rule of thumb methods.
4. Calculate vent sizes for multiple appliances (natural draft) using both sizing tables and rule of thumb methods.
5. List and describe regulations that relate to the minimum and maximum chimney sizing regulations that overrule chimney sizes determined from the chimney sizing tables.
6. Calculate chimney sizes for a single appliance using both sizing tables and rule of thumb methods.
7. Calculate chimney sizes for multiple appliances using both sizing tables and rule of thumb methods.
8. Describe the procedure for converting areas of round chimney to rectangular chimney and rectangular chimney to round chimney using sizing tables in the CAN/CSA B149.1 *Natural Gas and Propane Installation Code*.

B. Air Supply .....4 Hours

Outcome: ***Apply rules pertaining to the installation of air supply for appliances and calculate the size of air supply ducts, grilles and louvers needed for different applications.***

1. State the regulations in the CAN/CSA B149.1 and the *Plumbing and Gas Safety Services Bulletins* (*STANDATA*) pertaining to the air supply required to provide air for combustion, ventilation and flue gas dilution.
2. Explain the regulations in the B149.1 and the *Plumbing and Gas Safety Services Bulletins* (*STANDATA*) relating to air supply ducts and grille sizes required.
3. State and calculate the required duct size and free area ratios of the grilles for various applications.
4. State the regulations in the B149.1 and the *Plumbing and Gas Safety Services Bulletins* (*STANDATA*) pertaining to air supply by mechanical means.

C. Domestic Gas Fired Appliances .....8 Hours

Outcome: ***Apply rules pertaining to the installation of various domestic gas-fired appliances in regards to installer responsibilities, suitability, location, clearances to combustible materials and accessibility.***

1. List and explain regulations in the CAN/CSA B149.1 *Natural Gas and Propane Installation Code* and the *Plumbing and Gas Safety Services Bulletins* pertaining to domestic gas-fired appliances regarding installer responsibilities.
2. List and explain the regulations in the CAN/CSA B149.1 *Natural Gas and Propane Installation Code* and the *Plumbing and Gas Safety Services Bulletins* pertaining to conversions of domestic gas-fired appliances.

3. Describe methods of reducing clearances to combustible materials for domestic gas-fired appliances.

4. List and explain regulations in the CAN/CSA B149.1 *Natural Gas and Propane Installation Code* and the *Plumbing and Gas Safety Services Bulletins* pertaining to the installation of domestic gas-fired appliances.

D. Electricity for Gas Appliances and Controls ..... 6 Hours

Outcome: ***Select and utilize appropriate meter and test equipment to measure electrical values to service gas-fired appliances.***

1. List, define and describe common electrical terminology and the application of Ohm's law as used with ac and dc circuits for gas appliances and controls.

2. Identify electrical testing devices.

3. Describe proper settings for electrical testing equipment.

4. Describe proper methods for measuring amperes, volts and ohms in typical gas appliance circuits.

5. Describe proper procedures for determining continuity in wires, coils, circuits and other electrical components found on gas appliances.

6. Describe the use of test lights for determining continuity in wires, coils, circuits and other electrical components found on gas appliances.

E. Electrical Circuits for Domestic Gas Appliances and Gas Controls ..... 6 Hours

Outcome: ***Interpret electrical and electronic wiring diagrams and calculate volts, ohms and amperes.***

1. List and describe common types of electrical circuits found on gas appliances and controls: series, parallel and a combination of series and parallel circuits.

2. Apply Ohm's Law involving simple circuits for gas controls and appliances.

3. Identify various symbols found on electrical wiring diagrams for gas appliances and controls.

4. Match symbols on electrical diagrams with components on domestic gas appliances and controls.

5. Read and interpret wiring symbols.

6. Interpret various wiring diagrams: schematics, pictorial, and line (ladder) diagrams.

F. Gas and Electrical Controls ..... 8 Hours

Outcome: ***Determine the operational principles of controls, test and service controls, and properly set up and adjust various controls on gas-fired appliances.***

1. Identify and describe the operating principles of thermally operated controls.

2. List and describe adjustment techniques and routine maintenance requirements for thermally operated controls.

3. Describe proper technique for leak testing thermally operated controls.

4. Identify and describe the operating principles and procedure for determining voltage, amperage and wattage of electrical controls.

5. List and describe diagnostic techniques and routine maintenance requirements for electrical controls.

G. Propane Cylinders and Vaporization ..... 6 Hours

Outcome: ***Apply rules pertaining to the installation and service of bulk propane cylinders, service valves and accessories for various conditions of use.***

1. Interpret regulations in the CAN/CSA B149.2 *Propane Storage and Handling Code* and the *Plumbing and Gas Safety Services Bulletins* pertaining to customer propane storage cylinders on the customer's property.
2. List and describe criteria for sizing cylinders for customer's application.
3. List and describe installation procedures for cylinders including clearances, maintenance and code requirements.
4. List and describe safety relief valves used on propane storage cylinders including pressure settings, discharge piping locations and code requirements.
5. List and describe valves and accessories, including maintenance, on customer storage cylinders for vapour withdrawal.
6. List and describe valves and accessories, including maintenance, on customer storage cylinders for liquid withdrawal.

H. Domestic Appliance Installation and Servicing Lab (Including Mid and High Efficiency)..... 6 Hours

Outcome: ***Check the application of gas codes, manufacturer's requirements, rating plate data, pertaining to the installation of various domestic gas-fired mid and high efficiency appliances. Check for installer responsibilities, location, clearances, gas-line, vent and combustion air requirements.***

1. Check for correct installation requirements with reference to regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to gas-fired appliances regarding installer responsibilities.
2. Apply the regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins regarding to venting of domestic gas-fired appliances.
3. Apply the regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to combustion air requirements of domestic gas-fired appliances.
4. Assess correct installation requirements in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to domestic gas-fired appliances including (but not limited to): a) boilers, b) clothes dryers, c) counter appliances, d) direct vent and decorative appliances, e) ranges, f) furnace/space heating, g) domestic water heating.
5. Safely test and set appliances operating and safety controls to correct requirements.
6. Check that appliance is operating correctly and according to codes and manufacturer's requirements.

I. Appliance Gas Controls and Wiring Lab ..... 12 Hours

Outcome: ***Wire electrical and electronic wiring diagrams to required controls.***

1. Wire common types of electrical circuits found on gas appliances and controls: series, parallel and a combination of series and parallel circuits.
2. Apply Ohm's Law involving simple circuits for gas controls and appliances.
3. Identify various symbols on electrical diagrams with components on domestic gas appliances and controls.
4. Match symbols on electrical diagrams with components on domestic gas appliances and controls.
5. Interpret and apply various wiring diagrams: schematics, pictorial, and line (ladder) diagrams.

6. Safely test and set appliances operating and safety controls to correct requirements.
7. Check that appliance is operating correctly and according to codes and manufacturer's requirements.

SECTION FOUR: .....MATH, SCIENCE AND BLUEPRINT READING ..... 56 HOURS

A. Volumes, Capacities and Surface Areas .....4 Hours

Outcome: Implement mathematical calculations relevant to the trade.

1. Calculate the volumes and capacities of regular shaped tanks and flat end cylinders in metric and imperial units.
2. Calculate surface area and the total force on a surface area in metric and imperial units.
3. Calculate storm water capacities in metric and imperial units.
4. State the safe trenching requirements and calculate volumes of soil removed from various trench applications in metric and imperial units.

B. Square Roots, Piping Offsets and Fitting Allowance .....10 Hours

Outcome: Calculate square roots, piping offsets and fitting allowance.

1. Calculate square root using an appropriate calculator.
2. State the formula for calculating 22 ½ and 45 degree offsets.
3. Calculate offset travel using both imperial and SI units for unequal spread offsets.
4. Calculate offset travel using both imperial and SI units for equal spread offsets.
5. Calculate fitting allowance in both imperial and SI units.
6. Calculate cut lengths of pipe and tube in both imperial and SI units.
7. Perform an assigned parallel piping offset project to specific requirements and dimensions.

C. Fixture Spacing.....4 Hours

Outcome: Use manufacturers hand book to properly space bathroom fixtures in residential and commercial applications, for both normal and barrier-free installations.

1. With the aid of a manufacturers hand book state the minimum clearances for fixtures.
2. Design a typical bathroom stating fixture spacing requirements for both residential and commercial applications in metric and imperial measurements.
3. State the fixture spacing requirements in bathrooms that incorporate barrier-free design.

D. Grades and Elevations.....8 Hours

Outcome: Locate elevations and calculate grades.

1. Calculate grades in both imperial and metric units using appropriate formulas.
2. Calculate hanger spacing using applicable code spacing requirements.
3. Calculate vertical distances in both imperial and metric values using geodetic, abbreviated geodetic and architectural elevations.
4. Identify various types of builder's levels and list and describe terminology associated with the use of builder's levels.
5. Describe the use of builder's levels to determine prescribed elevations.

6. Demonstrate the safe use of builder's levels to located prescribed elevations.
7. Complete a survey record sheet.

E. Residential DWV Sketching ..... 6 Hours

Outcome: Draw residential plumbing installations using both SI and imperial measurements.

1. Sketch plumbing ground work to specifications using orthographic techniques.
2. Sketch plumbing ground work to specifications using isometric techniques.
3. Draw plumbing DWV stacks to specifications using isometric techniques.
4. Use manufacturers rough-in books for location of DWV connections.
5. Compile a material list required for the installation.
6. Using a material pricing manual, compile a price for a DWV system.

F. Commercial DWV Sketching and Drawing ..... 8 Hours

Outcome: Draw commercial plumbing.

1. Sketch commercial ground work to specifications using orthographic techniques.
2. Sketch commercial ground work to specifications using isometric techniques.
3. Draw commercial plumbing DWV stacks and branches to specifications using isometric techniques.
4. Use manufacturers rough-in books for location of DWV connections.
5. Compile a material list required for the installation.

G. Applied Blueprint Reading ..... 16 Hours

Outcome: Interpret residential and commercial blueprints.

1. Identify divisions of blueprints.
2. Interpret views of a building.
3. Identify various elevations and schedules.
4. Interpret site, floor and plot plans
5. Interpret specifications.
6. Identify plumbing fixtures and locations of fixtures.
7. Determine correct location of DWV and water distribution systems.
8. Analyze blueprints for possible installation conflicts.

FOURTH PERIOD TECHNICAL TRAINING
PLUMBER TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE: ..... PRIVATE WATER SUPPLY AND WATER TREATMENT ..... 56 HOURS

A. Introduction to Private Water Supply Systems ..... 4 Hours

Outcome: ***Interpret the requirements for a farm and residential private water supply system.***

1. Define the terminology pertaining to water wells.
2. Define terminology pertaining to a private water supply and list daily requirements for different applications.
3. Describe sources for private water supply and common sources of water supply contamination.
4. Describe the types of wells associated with private water supplies.

B. Pumps for Private Water Supply Systems ..... 8 Hours

Outcome: ***Interpret the sizing requirements for various pumps installed on a private water supply system.***

1. Describe basic scientific principles pertaining to the operation of a water supply pump.
2. Describe types, classifications and application of various pumps used on private water supply systems.
3. Describe procedure to correctly size a water supply system for various applications.
4. Describe installation procedure for water supply pumps including pipe sizing and electrical requirements.
5. Describe maintenance problems encountered when using pumps and common causes and solutions for these problems.

C. Private Water Supply Pressure System Components ..... 4 Hours

Outcome: ***Layout and install a private water distribution system that will meet the requirements set out for it and designed to allow ease of maintenance and upkeep.***

1. Describe components of a private water system.
2. Describe the relationship between head, pressure, friction loss and flow rates.
3. Describe the basic types of pressure tanks used on private water supply systems.
4. Describe correct installation procedure for private water system components including sizing and electrical requirements.
5. Describe maintenance problems associated with private water systems components including common causes and solutions for these problems.

D. Private Water Supply Pressure System Sizing ..... 8 Hours

Outcome: ***Interpret the requirements for a farm and residential private water supply system.***

1. Describe factors to consider when designing and sizing a private water supply system.
2. Describe how to size a pump and pressure system to deliver a required volume of water.

3. Describe the sizing procedure for a private water system for a farm application and a residential application.
4. List the tools and equipment required and describe the code requirements to complete a proper installation.
5. Perform assigned Pump and Pressure Systems Installation and Service project.

E. Introduction to Water Treatment ..... 4 Hours

Outcome: Layout and install a complete residential water treatment system.

1. Describe terminology pertaining to water, the water cycle and water treatment.
2. Describe the classes of water supply and sources of water supply.
3. Define the various types of hardness found in water, the effects of hardness on a water system and how to measure hardness.
4. Describe impurities found in water from various sources.

F. Impurities in Water ..... 6 Hours

Outcome: Layout and install a complete residential water treatment system.

1. List impurities found in water.
2. Describe the tests available to measure contaminants and identify when water treatment is required.
3. Describe water-associated problems caused by hardness.
4. Describe water-associated problems caused by other chemical impurities.
5. Describe water-associated problems caused by biological impurities.

G. Methods of Treatment and Equipment Installation ..... 12 Hours

Outcome: Interpret the sizing requirements for farm and residential private water supply systems.

1. Describe methods of treating contaminants in the water supply.
2. Identify the upper limits of each method of water treatment.
3. Identify the primary components of modern water treatment equipment.
4. Describe the operation and regeneration cycles of modern water treatment equipment.
5. State the method and calculate the capacity of various types of water treatment equipment.
6. Describe correct installation procedures for various types of water treatment.
7. Describe instructions for operation and maintenance for the customer.
8. List common maintenance problems and describe correct remedial procedures.
9. Perform an assigned Water Treatment Testing and Installation project.

H. Introduction to Private Sewage Disposal Systems ..... 6 Hours

Outcome: Apply rules necessary to complete a private sewage disposal system installation.

1. Describe regulations that apply to the design and installation of private sewage disposal systems.
2. Describe health hazards and environmental contamination that may occur through improper private sewage disposal.

3. Identify hazards present when working with private sewage system components.
4. Describe the steps for planning a private sewage disposal system.

I. Tour ..... 4 Hours

Outcome: Tour mechanical facility suitable for fourth period apprentices.

1. Identify major operating processes and equipment.
2. Identify the installed accessories and controls and list and describe their function.
3. Describe the requirements for safe installation of processes and applicable generating equipment, accessories and controls.

SECTION TWO: .....SPECIAL APPLICATIONS ..... 32 HOURS

A. Sustainable Technologies ..... 6 Hours

Outcome: Describe sustainable technologies utilized in the plumbing trade.

1. Describe LEED certification.
2. Describe the use of solar and geothermal technology.
3. Describe the process of rain water harvesting.
4. Describe the process of water reuse.

B. Introduction to Residential Fire Sprinkler Systems ..... 4 Hours

Outcome: Install and service piping and equipment to a residential sprinkler system using applicable regulations.

1. Identify codes that pertain to the installation of residential sprinkler systems and list advantages and disadvantages of residential sprinkler systems.
2. Describe proper design and installation of residential sprinkler systems.
3. Identify approved alarm requirements and describe how each alarm operates.
4. Describe testing and maintenance requirements for residential sprinkler systems.

C. Wet Standpipe and Dry Standpipe Fire Lines ..... 4 Hours

Outcome: Apply rules necessary to layout and install the piping and equipment for a wet and dry standpipe fire line system.

1. Define common terminology associated with wet standpipe and dry standpipe systems and compare the differences between standpipe systems and automatic sprinkler systems.
2. List the types of building in which wet standpipe and dry standpipe systems are installed including the advantages and disadvantages or each systems.
3. Describe the requirements and layout of a typical wet standpipe system.
4. Explain the types of fire hose cabinets, locations, accessibility and control valves for a typical fire hose cabinet installation.

D. Swimming Pools and Spas ..... 4 Hours

Outcome: Apply the rules necessary to install piping and equipment to swimming pools and spas.

1. Describe terminology that pertains to swimming pools and spas, chemicals used for treatment of swimming pool and spa water and MSDS requirements.

2. Describe the function of swimming pool and spa equipment and components.
3. Identify piping arrangements used to circulate pool water through related pool and spa equipment.
4. Describe regulations pertaining to the installation and maintenance of swimming pools and spas.

E. Compressed Air Systems ..... 4 Hours

Outcome: Install piping and equipment to a compressed air system.

1. Define compressed air and state the applications for compressed air systems.
2. Describe operation of system components.
3. Describe how impurities and environment effects the operation of compressed air systems.
4. Describe piping systems and correct installation procedures for compressed air systems.

F. Medical Gas Piping ..... 3 Hours

Outcome: Install and service medical gas piping systems.

1. Define medical gas piping and state the application for medical gas piping.
2. List the types of materials used to convey medical gas.
3. Describe installation procedures for medical gas piping systems and equipment.

G. Lawn Irrigation ..... 3 Hours

Outcome: Install and service a residential lawn irrigation system.

1. Define various types of irrigation systems including blueprint and piping symbols.
2. Describe layout and installation materials including trenching, piping, sprinkler heads and controls.
3. Interpret plumbing code requirements and manufacturer's specifications regarding appropriate cross-section control devices.

H. Hot Tapping and Freeze Isolation ..... 4 Hours

Outcome: Describe the procedure for tying into a live pipeline.

1. State the basic safety procedure for the use of a hot trap including proper valve selection and placement.
2. Identify assembly of the hot tap machine including proper valve selection and placement.
3. State problems that can arise if proper procedures are not followed.
4. List procedures for leaving installation in safe operating condition.
5. Describe the operation, precautions and applications of freeze packs used in the pipe trades.

SECTION THREE: ..... DRAIN WASTE AND VENTING ..... 50 HOURS

A. Interceptors and Indirect Wastes ..... 8 Hours

Outcome: Install and service various types of interceptors and plumbing for indirect wastes.

1. Define terminology associated with interceptors and describe various types of interceptors found in the plumbing trade.
2. Describe the function and application of various types of interceptors.
3. Describe the operation of various types of interceptors.

4. State the differences between various interceptors.
5. Describe installation procedures for various types of interceptors.
6. Describe proper grease and sludge disposal and health associated risks when working with various interceptors.
7. Describe terminology used to define wastes and identify applications.
8. Describe proper installation and maintenance procedures for various applications of indirect wastes.
9. Interpret code requirements for indirect wastes.

B. Sewage Sumps, Receiving Tanks and Dumping Stations ..... 6 Hours

Outcome: ***Install and service plumbing to sewage sumps, receiving tanks and dumping stations.***

1. Describe the types and functions of sewage holding or receiving tanks.
2. Describe installation, operation and maintenance requirements for sewage holding or receiving tanks.
3. Define mobile home park, recreational vehicle and dumping station and list material approved for use with these applications.
4. Describe installation procedures required for plumbing installations in mobile home parks and sewage dumping stations.
5. Describe maintenance requirements and code requirements for mobile home park and dumping station applications.

C. DWV, Water Distribution and Fixtures for Residential Installation ..... 6 Hours

Outcome: ***Size and Install DWV and domestic water systems in a residence.***

1. Layout and sketch, isometric style, various DWV systems for residential applications.
2. Describe proper installation procedures for above and below ground applications.
3. Describe location for expansion control and back water valves.
4. Size various DWV and water distribution systems in residential applications.
5. Interpret code requirements relating to DWV and water distribution, installation and testing.
6. List materials required for a residential application including fixtures, trim DWV pipe and fitting and water distribution piping and fittings.

D. Specialty Plumbing Fixtures ..... 16 Hours

Outcome: ***Install and service fixtures for industrial, institutional or hospital installations.***

1. Describe fixtures found in industrial, institutional and hospital applications.
2. Describe materials that industrial, institutional and hospital fixtures may be manufactured from, and describe precautions when handling and installing these fixtures.
3. Describe fixture trim required for industrial, institutional and hospital fixtures.
4. Describe various means of water on/off control on industrial, institutional and hospital fixtures.
5. State fixture unit ratings, water supply drainage and venting requirements for industrial, institutional and hospital fixtures.
6. Describe installation procedures for industrial, institutional and hospital code requirements.
7. Describe tools and materials required for installation of industrial institutional and hospital fixtures.

8. Identify carriers, hardware and state their function.
9. List materials and tools required to install a carrier.
10. Perform an assigned Water Closet Carrier Installation and venting project.

E. Commercial Equipment Installation ..... 14 Hours

Outcome: Install and service fixtures for commercial installations.

1. Describe fixtures found in commercial applications.
2. Layout, isometric style, a commercial DWV system.
3. Describe material requirements for DWV, water distribution, fixtures and trim.
4. Describe installation procedure for DWV, water distribution, fixtures and trim.
5. Describe appropriate cross connection control devices for various commercial applications.
6. Size a commercial DWV system.
7. Describe procedure for disposal of wastes over 75°C, (170°F).
8. Interpret plumbing code regulations for the installation of commercial fixtures.
9. Size a commercial water distribution system using the average pressure loss method.
10. Perform an assigned commercial rough-in DWV project to specific requirements and dimensions.

SECTION FOUR: ..... GASFITTING THEORY AND LAB ..... 64 HOURS

A. Low-Pressure Gas Line Layout Including Venting and Air Supply ..... 10 Hours

Outcome: Select, size and install gas line venting and air supply requirements for a large residential application.

1. Describe the process for the layout of the low pressure gas line for both natural and propane gas installations.
2. Apply all regulations pertaining to low-pressure gas line sizing.
3. Correctly size all gas lines using proper tables (minimum size requirements) and develop a material list.
4. Describe proper testing and purging requirements for low-pressure gas line installations.
5. Describe the process to correctly size the vent, vent connectors and chimney.
6. Describe the process to determine the correct air supply requirements.

B. 2 PSI Gas Line Layout ..... 4 Hours

Outcome: Install and service pipe, tubing and fittings to a 2-psi gas line installation.

1. Describe the process for the layout of a 2-psi gas line for a commercial installation.
2. Apply all regulations pertaining to 2-psi gas line sizing.
3. Correctly size gas lines using the proper tables (maximum size requirements) and develop a material list.
4. Describe testing and purging requirements for 2-psi gas line installation.

C. Customer Bulk Storage Tank Installation and Vaporizers ..... 6 Hours

Outcome: ***Apply rules pertaining to the installation of customer bulk storage tanks and vaporizers for various conditions of use.***

1. List code requirements for installation of customer bulk storage tanks.
2. Describe the process for sizing tanks for customer's applications.
3. Describe tank installation requirements including piping and regulators.
4. Describe valves and accessories for safety relief, liquid withdrawal, vapour withdrawal and filling applications.
5. List the types, sizing and capacities of vaporizers.
6. Describe code requirements, installation procedures and maintenance requirements for vaporizers.

D. Additional Vents ..... 4 Hours

Outcome: ***Install and service flues, vents and thermal and electric flue dampers.***

1. List and describe minimum distances and code requirements for the use of direct vented appliances.
2. List the code requirements for power-assisted flues, special vent applications and engineered designed vents.
3. Identify and describe various types of flue dampers including operation and code requirements.

E. Mid-Efficiency and High Efficiency Gas-Fired Appliances ..... 6 Hours

Outcome: ***Install and service gas-fired appliances and interpret timing and sequencing diagrams on electronic appliances and gas controlled equipment.***

1. List and describe the basic differences between mid and high efficiency appliances.
2. List the code and manufacturer requirements for the installation of mid and high efficiency appliances.
3. Identify and describe the operation of each of the basic ignition systems used in mid and high efficiency appliances.
4. Interpret timing and sequencing diagrams found on mid and high efficiency appliances.
5. List and describe troubleshooting procedures for mid and high efficiency appliances.
6. State the regulations in relation to air supply requirements for mid and high efficiency appliances.

F. Electrical Circuits and Controls for Commercial Gas Appliances ..... 6 Hours

Outcome: ***Interpret electrical and electronic wiring diagrams.***

1. Identify electrical and electronic symbols used in gas control and appliance circuits for both ac and dc power.
2. Match symbols on electrical circuits with components on commercial appliance and control equipment.
3. List and describe the common types of electrical circuits found on gas controls and appliances.
4. Identify and describe electrical and thermally operated controls for commercial appliances.
5. List, define and describe common electronic terminology used in gas control and appliance circuits for both ac and dc power.
6. Describe troubleshooting procedures for electronic and electrical controls and appliances.

G. Combustion Analysis and Heat Exchanger Testing ..... 4 Hours

Outcome: ***Install and service gas-fired appliances.***

1. Explain factors relating to gas combustion efficiency in natural draft, low pressure gas appliance including effects of air supply.
2. Describe correct methods for testing and adjusting combustion characteristics of gas appliances including methods of testing for carbon monoxide.
3. Describe best methods of using combustion analysis test kits.
4. Explain various methods used to check the condition of the heat exchangers.

H. Wiring Electrical Circuits for Mid and High Efficiency Gas Appliances ..... 6 Hours

Outcome: ***Using wiring diagrams wire circuits to mid and high efficiency appliances having electrical and electronic controls.***

1. Identify electrical and electronic symbols used in gas control and appliance circuits for both ac and dc power.
2. Match symbols on electrical circuits with components on commercial appliance and control equipment.
3. Identify the common types of electrical circuits found on gas controls and appliances.
4. Identify and describe electrical and thermally operated controls for commercial appliances.
5. List, define and describe common electronic terminology used in gas control and appliance circuits for both ac and dc power.
6. Correctly wire circuits to mid and high efficiency appliances using manufactures wiring diagrams.
7. Follow prescribed troubleshooting procedures for electronic and electrical controls and appliances.

I. Operational Tests for Mid and High Efficiency Gas-Fired Appliances ..... 6 Hours

Outcome: ***Install and service gas-fired appliances and interpret timing and sequencing diagrams on electronic appliances and gas controlled equipment.***

1. Identify the basic differences between mid and high efficiency.
2. List the code and manufacturer requirements for the installation of mid and high efficiency appliances.
3. Test the operation of each of the basic ignition systems used in mid and high efficiency appliances.
4. Interpret timing and sequencing diagrams found on mid and high efficiency appliances.
5. Test for correct combustion analysis with kits and adjust appliances for maximum safety and efficiency.
6. Follow troubleshooting procedures for mid and high efficiency appliances. Check condition of heat exchanger.
7. Review regulations and manufacturers specifications and measure flue gas temperature, excess air ratio and check compliance of air supply for mid and high efficiency appliances.
8. Tabulate data and discuss results.

J. Domestic Gas Fired Appliances Installation and Servicing Lab ..... 6 Hours

Outcome: ***Check the application of gas codes, manufacturer's requirements, rating plate data, pertaining to the installation of various domestic gas-fired mid and high efficiency appliances. Check for installer responsibilities, location, clearances, gas-line, vent and combustion air requirements.***

1. Check for correct installation requirements with reference to regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to gas-fired appliances regarding installer responsibilities.
2. Apply the regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to venting of domestic gas-fired appliances.
3. Apply the regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to combustion air requirements of domestic gas-fired appliances.
4. Assess correct installation requirements in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to domestic gas-fired appliances including (but not limited to): a) boilers, b) clothes dryers, c) counter appliances, d) direct vent and decorative appliances, e) ranges, f) furnace/space heating, g) domestic water heating.
5. Safely test and set appliances operating and safety controls to correct requirements.
6. Check that appliance is operating correctly and according to codes and manufacturer's requirements.

K. Set and Adjust Gas Appliances ..... 6 Hours

Outcome: ***Set and adjust gas fired appliances with respect to gas codes, manufacturer's requirements, and rating plate data.***

1. Check for correct installation requirements with reference to regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to gas-fired appliances regarding installer responsibilities.
2. Apply the regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to venting of domestic gas-fired appliances.
3. Apply the regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to gas pipe sizing, correct wire gauge and combustion air requirements for domestic gas-fired appliances.
4. Assess correct installation requirements in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to domestic gas-fired appliances including (but not limited to): a) boilers, b) clothes dryers, c) counter appliances, d) direct vent and decorative appliances, e) ranges, f) furnace/space heating, g) domestic water heating.
5. Safely test and set appliances operating and safety controls to correct requirements.
6. Check that appliance is operating correctly and according to codes and manufacturer's requirements.

SECTION FIVE: ..... MATH, SCIENCE AND BLUEPRINT READING ..... 38 HOURS

A. Trade Math and Science ..... 10 Hours

Outcome: ***Calculate hydrostatic pressures, rolling offsets, volume, flow volumes in pipe and grade on pipe in both metric and imperial units.***

1. Calculate hydrostatic pressure.
2. Calculate rolling offsets in a piping system.
3. Calculate the volume of various shapes of tanks.

4. Calculate the flow from pipe.
5. Perform an assigned rolling piping offsets project to specific requirements and dimensions.

B. Schematics and Waterline Sketching ..... 6 Hours

Outcome: Interpret a schematic drawing, and draw the distribution from a blueprint.

1. Describe a schematic drawing.
2. List the information found on a schematic drawing.
3. Describe the process for drawing a schematic.
4. Describe the procedure for drawing waterlines in residential and commercial applications.

C. Commercial Kitchen Layout and Barrier-Free Washroom Design ..... 8 Hours

Outcome: Draw residential and commercial plumbing installations.

1. Describe the layout requirements for a commercial kitchen.
2. Review a kitchen equipment specification.
3. Define common terminology associated with barrier-free applications.
4. Describe various methods of locating fixture rough-in requirements.

D. Job Estimating ..... 4 Hours

Outcome: Describe and implement the fundamentals of estimating.

1. Review various methods used to tender and estimate for a project.
2. Describe the types of bonds that may be required for a project.
3. Estimate an assigned project.

E. Blueprint Package ..... 6 Hours

Outcome: Interpret commercial and industrial blueprints.

1. Identify divisions of blueprints.
2. State the information applicable to the plumber trade found on blueprints.
3. Review the application of grid lines.
4. Identify plumbing fixtures and locations of fixtures.
5. Interpret site, floor and plot plans.
6. Interpret specifications.
7. Determine location of DWV and water distribution systems.
8. Analyze blueprints for possible installation conflicts.

F. Workplace Coaching Skills ..... 2 Hours

Outcome: Display coaching skills

1. Describe coaching skills used for training apprentices.

G. Alberta's Industry Network ..... 2 Hours

Outcome: ***Describe the role of the Alberta Apprenticeship and Industry Training Board and the network of industry committees that represent the trades and occupations in Alberta.***

1. Describe Alberta's apprenticeship and industry training system.
2. Describe the roles and responsibilities of the Alberta Apprenticeship and Industry Training Board, government and post secondary institutions.
3. Describe the roles and responsibilities of the PAC's, LAC's, and occupational committees.

H. Interprovincial Standards ..... 2 Hours

Outcome: ***Use Red Seal products to challenge an interprovincial examination.***

1. Identify Red Seal products used to develop interprovincial examinations.
2. Use Red Seal products to prepare for an interprovincial examination.

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